October 26, 1933

Engineering News-Record

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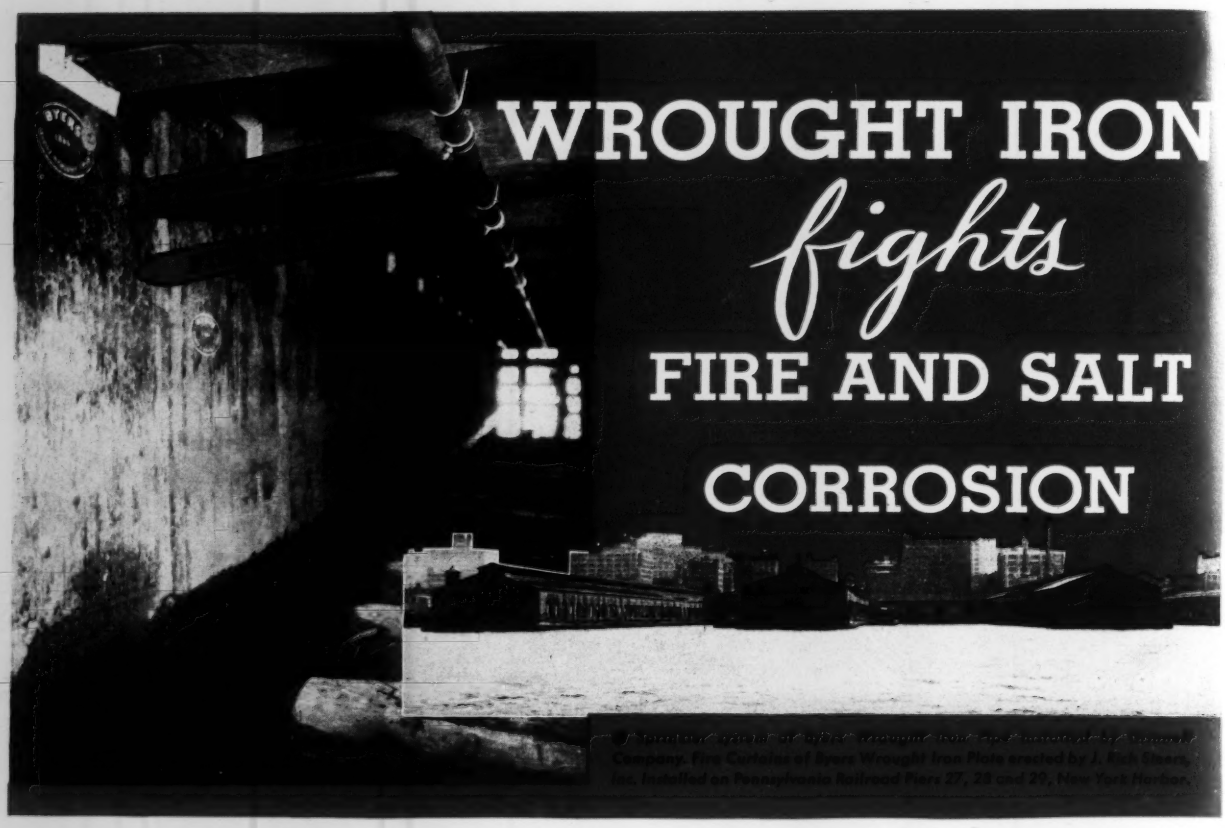
Construction Writes A Constitution

UNIQUE AMONG INDUSTRIES because of its dispersed nature, construction will be more profoundly affected than any other by NRA code self-government. A comprehensive system of codes tied into a master code has been developed by leaders of the industry during three months of patient work at Washington, and now the key codes are near the point of approval. They are designed to wipe out unscrupulous competition and establish healthy industrial and human relations. They will have revolutionary effect on professional, contracting and supply circles.

WILL CONSTRUCTION OPERATIONS BE HAMPERED in their freedom and flexibility? Will costs be increased and progress jeopardized? Are established practices of planning, bidding and buying likely to be changed? Does the code practice affect only the big operations? Such questions are being asked everywhere outside of Washington. To answer them this issue brings an important statement on the contents and purposes of the code system by Stephen F. Voorhees, chairman of the Construction Code Committee, which addresses itself to all elements of the industry and invites their study and cooperation. Clear understanding of the process by which the codes were made is afforded by a companion article on code-making, by James W. Follin, secretary of the committee.

OTHER ARTICLES: Steel Sheet Pile Jetty at Pensacola . . . Soil-Bearing Tests for Columbus Water Tanks . . . Metal-Faced Gravel Dam in New Mexico . . . Truss and Beam Continuity in Highway Bridges . . . The Emergency Road Program as of October 1



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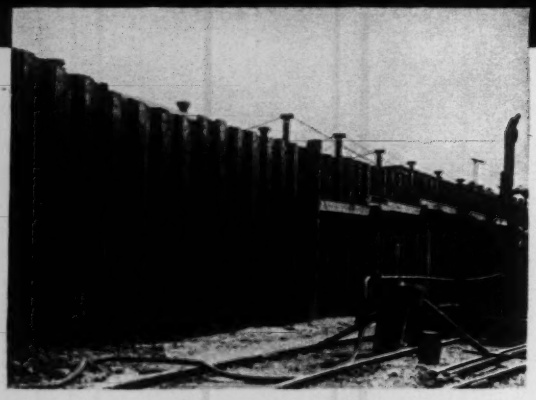
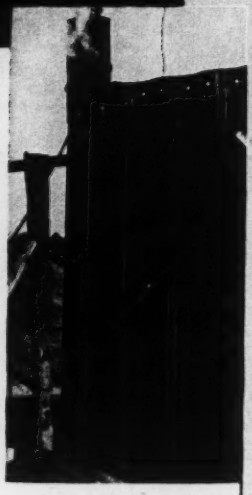
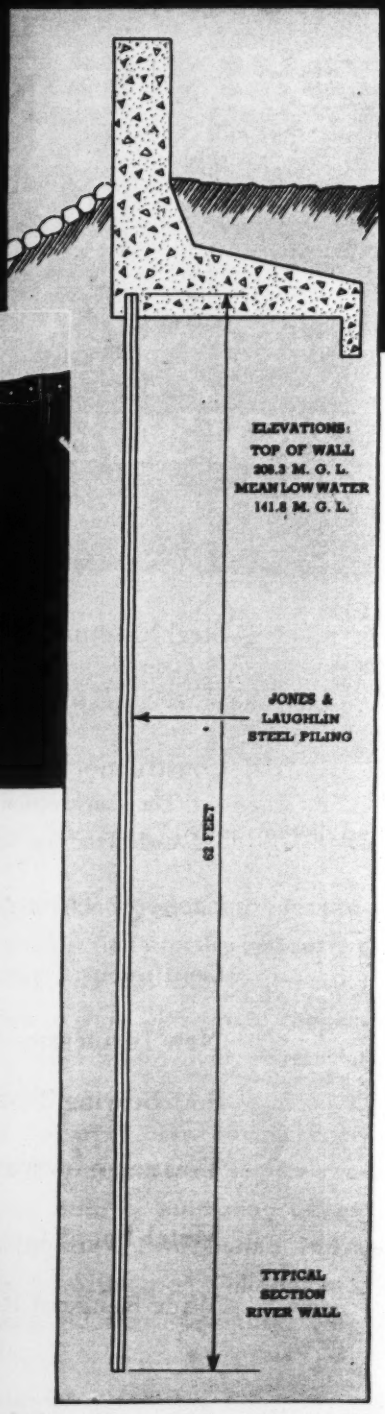
J&L STEEL PILING SELECTED FOR USE IN FLOOD PROTECTION PROJECT AT HELENA, ARKANSAS: 1770 TONS DRIVEN







Above—A section of the J & L Steel Piling cutoff wall at Helena, Ark., assembled ready for driving.

Right—Driving operation of the cutoff wall.

THE selection of J & L Steel Piling for the cutoff wall work of the Mississippi River flood control project at Helena, Ark., is evidence of the wide acceptance of J & L Steel Piling for river and seawall construction.

The project was designed and constructed under the direction of Major Brehon B. Somervell, District Engineer, United States Engineer Office, Memphis, Tenn. The contractor for the project was the C. G. Kershaw Contracting Company of Birmingham, Ala.

J & L Steel Piling was also employed in the recently constructed flood control projects at Cairo, Ill. and Caruthersville, Mo.

The Jones & Laughlin Steel Corporation maintains a special engineering staff and invites inquiries on all types of steel piling projects, which will be analyzed promptly and reported upon in detail.

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Steel Sheetpile Jetty at Pensacola

Steel sheeting used in two ways for 1,300-ft. jetty to prevent shoaling in Pensacola Bay, Fla., a link in the Intracoastal Waterway

By Edgar K. Foster and Donald E. Young

Assistant Engineer and Draftsman, Respectively, U. S. Engineer Office, Montgomery, Ala.

SOME TIME after the completion of the section of the canal between Pensacola Bay and Perdido Bay, Fla. (a link in the Intracoastal Waterway) it was found that the entrance from Pensacola Bay at the east end had shoaled from its original depth of 10 ft. to as little as 1 ft. at the center line. Since the canal is roughly parallel to the coast, the approach to the canal is directly across the entrance to the harbor at Pensacola. Tidal currents through the entrance to the harbor and currents set up by southeasterly winds combined to cause the sand of the beaches to drift into the canal. The resultant shoaling was so rapid that dredging to maintain a navigable channel of the project depth would be expensive.

In order to prevent this shoaling and also to provide protection for traffic to the canal in rough weather, it was decided to build a jetty between the entrance to Pensacola Bay and the south side of the canal. While the function of the jetty would be to prevent shoaling and to protect navigation in the canal, it had to be built sufficiently strong to withstand high seas that roll in through the mouth of the harbor from the Gulf of Mexico. A composite jetty of steel sheetpiling with rock or concrete fill was decided upon.

Design and structure

The jetty started at the concrete seawall of old Fort McRae (Fig. 2) and extended across a sand pit into the bay for a total length of 1,300 ft. It was designed in two sections (Fig. 3). The first 700 ft. was designed with one row of sheetpiling with buttress piles every 16 ft. The second section, 600 ft. long, was designed with two rows of piling of the same kind, with the rows spaced 10¾ ft. center to center and the inclosure

Fig. 1—Buttressed sheetpile portion of new jetty at Pensacola, Fla. Outer 600 ft. consists of two rows of sheetpiling inclosing a rockfill.

filled with sand and rock or concrete. The jetty terminated in an octagon head. All steel piling was held by channel wales consisting of one channel bolted on the piles. Section 2 was protected by riprap around the head and along the outermost 100 feet.

Plans and specifications were made for two designs (Fig. 4), both using the same lay-out of piling except for a different arrangement of the waling; the first plan called for a reinforced-concrete cap; the second required a rockfill with a cover of derrick stone. Upon opening the bids it was found that the jetty could be built somewhat cheaper with the rockfill, and that design was therefore approved by the engineer department.

Sheetpiling

The distinctive feature of the jetty is the use of steel piling. The utilization of steel in this class of structures has not been extensive on account of corrosion, which is accelerated by salt water. However, steel has been used in some marine structures, and corrosion has not been so rapid as to preclude a reasonably long life of the structure. On the other hand, any wooden jetty on this location would be subject to destructive attacks of marine borers, particularly the teredo. This contingency eliminated wood construction. For reasons of cost, reinforced-concrete piling could not be used. It was therefore decided to use sheetpiling of carbon steel with the addition of a small amount of copper to resist corrosion.

Through correspondence with steel manufacturers, it was learned that copper-bearing steel could be obtained at an additional cost of $2 per ton of piling. The composition of the steel was subject to these limits: phosphorus, not over 0.06 per cent; sulfur, not over 0.06 per cent; copper, not less than 0.25 nor more than 0.35 per cent.

The type of piling specified was arched-web, with a width of not less than 16 in. c. to c. of interlock; thickness of web not less than ⅜ in. and a thickness of flange not less than ⅝ in.

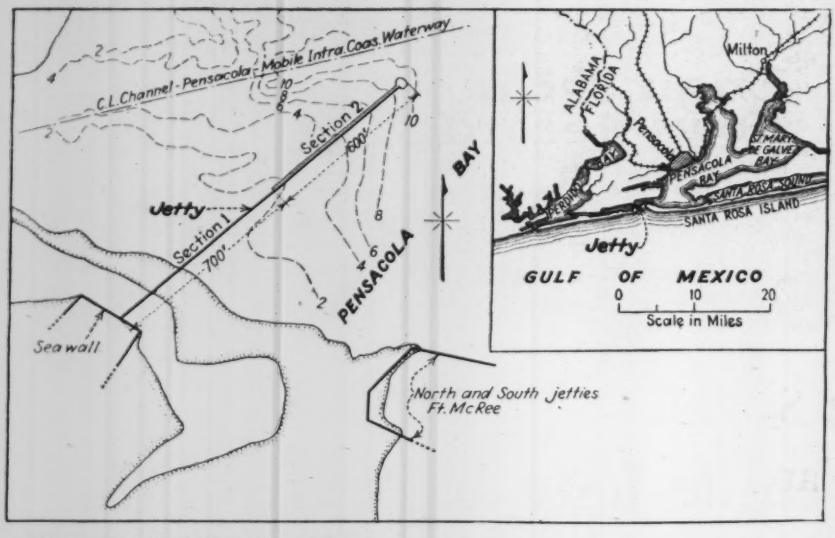


Fig. 2—General and detail maps of Pensacola Bay, showing location of new jetty.

The weight should be 25 lb. per square of wall, the section modulus not less than 10 in.³ per foot of wall and the ultimate strength not less than 60,000 lb. per sq.in.

All sheetpiling was bound by means of a channel waling, which was bolted on the outside of the piling in section 2 and opposite the buttresses in section 1. The same size of channel was used throughout—namely, 10 in. by 15.3 lb. In section, a 1¼-in. tierod passing through the waling connected both rows of piling. This arrangement is clearly shown by the drawings. The waling, tierods and all connections had to conform to the same specified content of copper as the sheetpiling.

Construction

For the rockfill, it was specified: "Stone shall be hard angular quarry stone of a durable quality that will not disintegrate and shall not weigh less than 150 lb. per cubic foot." The bottom course consisted of a graded mixture of stone varying from 10 to 150 lb. each. The top course was capstone varying from 1 to 4 tons each. The rock approved and used for both the fill and riprap was marble from quarries near Sylacauga, Ala. Tests made on samples of this rock showed a weight of about 168 lb. per cubic foot; compressive strength was 12,900 lb. per sq.in. parallel with the bed; absorption after immersion for two weeks was 0.0006 per cent, or practically nothing.

In the plan and specifications for the jetty with the concrete design of cover, the lay-out of piling was the same; section 1 with the one row of piling was, of course, unaffected. In section 2, the only difference was in the waling which, with the concrete top, consisted of two channels placed back to back and located on the inside of the piling. The two channels were spaced far enough apart by spacers and bolts to allow tierods to pass through and bolt on the outside of the piling. The channels in the horizontal position then functioned as a footing for the concrete. The arrangement is shown in the drawing.

Upon letting the contract the contractor proposed changing the shape of the head from the octagon to a circular design in order to facilitate construction. This change was approved by the engineer office. No other changes were made except that, upon completion of the work, additional riprap was piled at intervals along the outer end of section 2 to the top of the piling.

The contractor received notice to proceed with the work on Nov. 30, and, since the specification allowed 100 days for completion, the work was scheduled to be completed March 10, 1933. Preparation began shortly after Nov. 30, and the contractor was ready to start construction by Dec. 22, 1932. However, the jetty was actually completed on June 30, 1933.

Although the work was protected from the westerly directions, it was exposed to winds and ground swells from easterly and southerly directions from the Gulf of Mexico and a long stretch over Pensacola Bay. From Dec. 22 to June 30, 1933, there are 191 calendar days. An analysis of the time spent, as reported by the inspector, shows that the following use was made of the time:

	Per Cent of Time
Sundays and holidays observed	17 or 9
Days on which work was done	131 or 68
Days lost on account of wind or weather	30 or 16
Days lost on account of ground swell	13 or 7

Naturally, on many of the days included in "days worked," only a small amount of work could be accomplished.

Not on all days could such work as piledriving or placing of waling be conducted. However, after construction was under way, different phases of the work could be arranged so that piling could be driven on the comparatively calm days. It will be noticed that ground swell, by which is designated the wave action that continues after the storm subsides, caused a loss of 7 per cent of the time, which is an appreciable

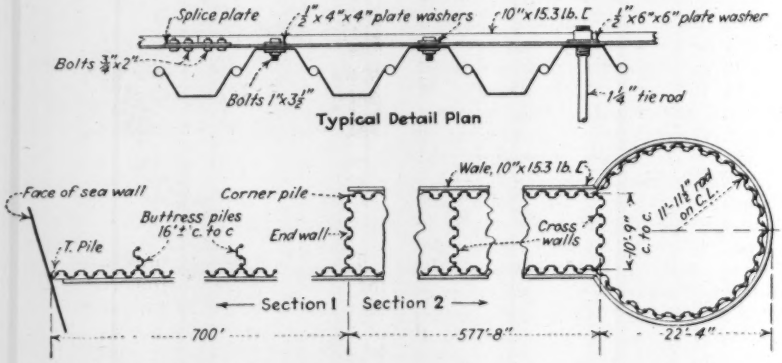
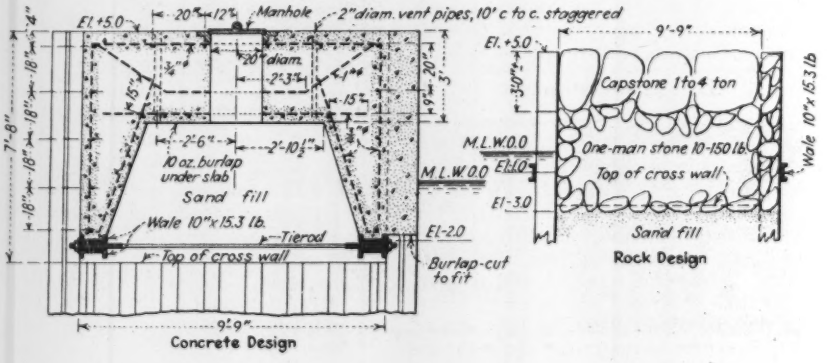


Fig. 3 (above)—Details of two types of structure for jetty at Pensacola harbor.

Fig. 4 (below)—Two types of capping planned for jetty at Pensacola harbor.



BID PRICES FOR COMPOSITE JETTY AT PENSACOLA HARBOR

Quantities	Unit	Item	No. 1	No. 2	No. 3	No. 4
20,725	Sq.ft.	Piling and connections, Sect. 1	$18,652.50	$20,725.00	$18,652.50	$21,968.50
42,560	Sq.ft.	Piling and connections, Sect. 2	38,304.00	35,112.00	38,304.00	40,091.52
3,700	Tons	Rockfill, Sect. 2	17,575.00	19,980.00	19,240.00	14,652.00
375	Cu.yd.	Sand excavation	187.50	112.50	375.00	56.25
380	Cu.yd.	Sandfill	190.00	152.00	190.00	190.00
395	Tons	Riprap stone	1,975.00	1,975.00	1,580.00	1,564.20
		Totals	$76,884.00	$78,056.50	$78,341.50	$78,522.47
		Days for completion	100	150	100	119

proportion of the total amount of time.

The quantities and bid prices of the four low bids are shown in the accompanying table.

The jetty was designed and constructed under the general supervision of Major R. A. Sharrer, district engineer. The plans were made by Donald E. Young, draftsman, U. S. Engineer Office, Montgomery, Ala. The Horace Williams Co., New Orleans, La., was the contractor.

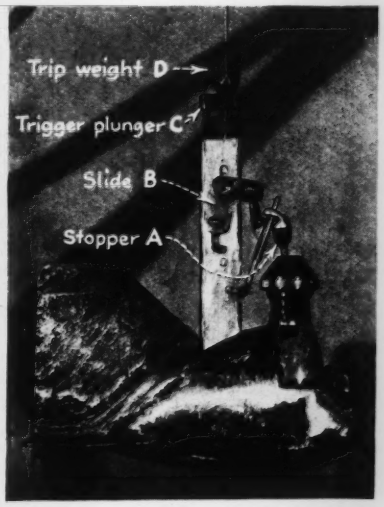
New Type of Silt Sampler Developed for Water Studies

By A. H. Frazier
Assistant Engineer, U. S. Geological Survey, St. Paul, Minn.

SILT in streams affects the development and utilization of the surface water resources of the country, and there has been a growing demand for definite data as to the silt content of streams, especially in connection with the development of storage. The United States Geological Survey, in cooperation with other agencies, has made investigations on various streams to determine the total silt content and the volume which the silt will occupy when deposited in reservoirs or canals. The most extensive silt studies in this country are those that have been made in the Colorado River drainage basin in connection with problems relating to the Boulder Dam.

For determining the quantity of silt carried by a surface stream, samples of water are taken at selected points in the stream. Various appliances for collecting samples have been devised to meet special conditions, but none of them has been well adapted for general use. In connection with river studies in the upper Mississippi River drainage basin, in which the United States Geological Survey is cooperating with the army engineers, the writer has developed a silt sampler which has several improvements over samplers that have been previously used.

This sampler, illustrated above, consists of a standard pint milk bottle, held in a 40-lb. bronze weight of streamline design, which offers a minimum resistance to the current of the water. The bottle is opened and closed by a stopper operated by small weights dropped down the suspending cable by the observer. The sampler is suspended by a cable in the same manner as a current meter and can be readily operated from bridge, cable or boat. It is adapted for the collection of samples anywhere in the cross-section of the stream to a depth within less than a foot from the bottom.



The new silt sampler, using an ordinary milk bottle as a container, is designed for easy and rapid operation.

The device for opening and closing the bottle is the most important feature of the sampler. It consists essentially of a double trip built into the oval tube from which the bronze weight is suspended, and a sealing arrangement that is fitted into the neck of the bottle. At the top of the sealing arrangement is a rubber stopper that is connected through a series of fittings to a pair of L-shaped plates that slide vertically along the flattened sides of the tube. The plates are separated by three studs, one of which is located outside the tube and connected with the stopper fittings, the other two passing through a slot in the tube. The upper one of the two studs that pass through the slot is attached to the suspending cable and supports the entire weight of the sampler; the lower engages with a trip arrangement and holds the slide in the desired position.

The illustration shows the relative position of the parts when the sampler is at the desired depth in the stream and the bottle is being filled. The L-shaped slide (B) has been moved to a position about an inch above the bottom of the slot, and the stopper (A) has been drawn out of the bottle an equivalent amount. This has been accomplished by dropping the weight (D) down the suspending cable. The impact of this weight depressed the trigger plunger (C), which released the lower stud of the slide and permitted the bronze weight and sample bottle to drop an inch, thus pulling the stopper out of the bottle.

When a second weight is dropped down the cable, the trigger plunger is depressed, the trip is again released, and the bronze weight and the bottle drop until the slide is at the top of the slot. During this action the stopper is freed from the slide assembly, and it is then drawn into the bottle by a spring within the sealing device.

When the sampler is raised to the surface, the bottle containing the sample is removed. The trigger is cocked by lowering the slide to its lowest position in the slot. A clean bottle is inserted, and the sampler is again ready to be submerged.

States Spent $955,000,000 for Highways Last Year

State highway expenditures in 1932 amounted to $955,446,000, according to information collected from state authorities by the Bureau of Public Roads, U.S. Department of Agriculture. Of this amount $816,765,000 was expended for construction and maintenance of highways, interest on bonds and notes and miscellaneous expenses. These items represent the capital investment and current expenses on account of state highways. Other disbursements, such as principal payments on bonds, transfers to local road authorities and obligations imposed by statute totaled $138,681,000.

Maintenance of the state systems, which include 358,210 miles of main highways, gave employment to from 130,000 to 160,000 men throughout the year. States surfaced 29,500 miles of road and more than 6,000 miles were graded. The direct employment furnished by this construction was 86,000 men in January. This rose to 215,000 in September and was 144,000 in December. For every man directly employed, two others were indirectly employed in supplying and transporting materials and machinery.

Total funds available were $1,173,576,000, consisting of $275,259,000 balance from previous year, $632,200,000 current revenue from state sources, $161,467,000 federal and local contributions, and $104,650,000 from sale of bonds and notes. More than 90 per cent of the current state revenue was derived from motor-vehicle fees and gasoline taxes.

The Construction Codes Today

A comprehensive system of divisional industry codes correlated by a master code is nearing completion—Under decentralized administration with unified control, it is adapted to furthering sound competition, stabilizing labor relations and raising the efficiency of the art

By Stephen F. Voorhees
Architect; Chairman of the Construction Code Committee, Construction League of the United States, Washington, D. C.

THE CONSTRUCTION codes are nearing completion after months of patient work. When they are promulgated, the construction industry will for the first time be a coordinated, efficiently organized entity, with trade practices soundly controlled in the public interest and with labor conditions protected by an effective mechanism of stabilization. At this significant time the leader of the code-making activities outlines the status of the codes and points out the essential purposes and methods of the new integration and control which the codes will achieve.
—EDITOR.

FOR THE past three months the construction industry has been engaged in writing its constitution, in the form of a correlated group of NRA codes. This complex undertaking, which has involved many difficulties, is now so far advanced that a key group of the codes is believed to be within a week or two of official approval and promulgation by the President. A new era of self-government and sound control of practices in the construction industry is therefore directly before us.

How the undertaking began

Earlier work on independent codes by several major divisions of construction, during and immediately after passage of the Recovery Act, showed that the problems of the industry could not be solved effectively without thorough correlation. For this reason systematic work was begun the middle of July, under the sponsorship of the Construction League, to develop a basic or master construction code. Simultaneously, however, the professional or trade associations of the division carried forward their own code work in harmony with the progress of the master code, to provide the necessary supplemental codes.

The master code went through its public hearing before the National Recovery Administration on Sept. 6, was subsequently discussed and revised repeatedly, and now awaits only the completion of final negotiation of minimum wage and maximum hour limits to be ready for submission and approval. More than a dozen supplemental codes also have gone through public hearings and are nearly abreast of the master code, among them those of architects, engineers and general contractors and several of the major trades, such as plumbing and heating, plastering and painting.

Within a short time, then, a foundation will have been laid for placing construction in the position of an integrated industry, organized to establish and enforce sound business practices and to adjust labor relations on a stable constructive basis with due adaptation to local conditions. Beyond question, this result will also make the art more efficient, for the construction field has never before known unity or cooperation, and due to the fact that its several elements have been consistently independent or even hostile, all parties involved suffered injury—the buyer of construction, the engineer or architect, the contractor and the worker in the construction crafts.

Reference to the general construction code, or master code, will best indicate the content and scope of the codes and their relation to the subsequent operative administration. Like all codes under the Recovery Act, each of them is designed to regulate wage and hours of labor and provide for such self-government of its branch of the industry as will promote stability of operation and employment and will eliminate unsound practices. This applies equally to the master code, which covers the construction industry as a whole, and to the supplemental codes, which cover specific divisions or types of activity.

What the codes contain

Five main elements of the master code warrant attention. This code:

1. *Defines the construction industry* in comprehensive terms, as comprising the designing and constructing of building structures and fixed structures and improvements intended for use in commerce and industry as well as installing, assembling and applying manufactured parts.

2. *Fixes hours and wages.* The present draft sets 40 hours per week as the maximum six-months average with a 48-hour maximum in any one week (except in supervisory, emergency or clerical work, or in very small establishments). This is intended to be a general rule throughout the industry, but as the conditions arising in specific divisions cannot be fully foreseen or provided for, a special clause recognizes the right of any supplemental code to except certain classes of employees or work under particular conditions. The age limit of sixteen years is fixed. The minimum hourly wage rate is fixed at 40c., except that 30c. is set as the minimum for work paid at an hourly rate of less than 40c. on July 15, 1929. Weekly rates are set for clerical employees. Exceptions may be made in the supplemental codes for special classes. None of the rates has application to work governed by federal, state or local wage rules or by binding labor agreements.

3. *Provides for area agreements* on hours, wages, etc. The essential clause, a highly important feature of the code, reads:

> Standards as to maximum hours of labor, minimum rates of pay, and such other conditions of employment as may be necessary to effectuate the policies of Title I of the Act, may be established nationally or for a specific region or locality by mutual agreement hereafter arrived at through bona fide collective bargaining between truly representative groups of employers and employees in the industry, or in any division or subdivision thereof, upon the approval of such mutual agreements in the manner hereinafter described.

4. *Establishes an administrative system* consisting of a Construction Code Authority of nine appointed by the policy committee of the Construction League, and three non-voting members appointed by the Administrator. This Authority must be truly representative. It may establish rules and regulations and may delegate its duties to committees, agencies and representatives. Its functions are to collect and furnish to the Administrator such statistical information as he requires, to report on conditions within the industry, to collect from the members of the industry the cost of administration, to propose modifications of the code where thought desirable, to recommend other supplemental codes where sound operation of the industry requires them, to administer and supervise operation of the master code, and to decide questions arising between supplemental code authorities. As part of the system of administration, the registration of construction contracts made directly with the owner is authorized, for a charge of not to exceed 1/50 of 1 per cent of face value of contracts exceeding $2,000, with a minimum charge of $2. This registration charge is expected to cover the cost of

the general code authority and of its local agencies and supplemental code authorities in Washington.

5. *Defines basic fair practice rules* applicable to the construction industry as a whole. These relate to competitive bidding practices only. The rules prohibit bid-peddling or bid shopping, prohibit inviting "an unnecessary number of bids," require prequalification, suggest that duplicate bids be filed with designated depositories under rules to be established by the supplemental codes, and prohibit collusion or rebating.

Necessity of coordination

The construction field is characterized by two essential peculiarities. First, in each case it involves the joint activity of a number of different functional agencies, such as designer, builder, subcontractor, supplier of materials, builder of machinery and equipment. Second, its product is fixed in location, as contrasted with products of manufacture, which are completed in the factory and later are transported to the point of use. It is these two peculiarities that dictate the entire philosophy of the codes and their administration.

Taking up the first point: Because all of the numerous functional agencies involved in a given construction enterprise have a share in determining both trade practices and labor relations, it is impossible to control the industry in the interests of sound practice unless all these agencies or divisions are effectively coordinated.

And this necessity of coordination extends not only over all the agencies participating in the field work but also over the professional agencies—the architects and engineers. Truly competitive bidding, for example, cannot be established and enforced if the buyer (the awarding authority) and the bidder do not join in adhering to lawful methods. It therefore became essential to success in the construction code program to begin with the principle of coordination. This is the reason for the formation of the general construction code committee to draft a master code, and for the provision of a General Code Authority as principal administrative agency of the entire system of codes. This also is the reason why codes for architects and engineers had to be written as a necessary part of the system, even though a strictly professional viewpoint would make it seem inappropriate to place professional operation under an industrial code.

Success of the sought-for coordination is, in short, the vital prerequisite to success in any improvement of self-government of the industry. But this cannot be accomplished by writing a single construction code covering all functions and operations of the industry, since the requirements of the several divisions are quite individual. Thus, the group of supplemental codes for the several divisions is indispensable.

It is important to note among the supplemental code groups that construction materials were not included. This resulted from an early decision of the Administrator that the materials industries should be dealt with as elements of the general manufacturing industry classes to which they belong.

The local factor in construction

Coming to the second peculiarity of construction, it will be recognized that a building, bridge or other structure is fixed in location at the point where it is built, and that therefore the industrial conditions of construction are subject to the influence of locality. No matter where the contractor's home office may be, the working conditions on any particular job that he carries out are determined by the habits, trade customs, cost of living and other conditions of the place where the job is being done.

Under these circumstances, construction conditions obviously cannot be made sound and stable unless they are adapted to the job locality. This does not mean that separate codes must be written for all localities in the United States, but it dictated the plan of administering the code provisions on a local-area basis. For this purpose the master code makes provision for local agreements to be added, where necessary, to the general and divisional code regulations.

The local area agreement clause quoted earlier in this article is therefore a clause of great importance, not only in respect to permitting local agreements to be made, but also in implying the necessity of a corresponding local administration of all the codes.

Evolution of administrative system

In broad outline the administrative system by which the code will be applied is dictated by the considerations already indicated, including the principles of maximum local and functional autonomy on the one hand, and complete coordination on the other. In detail, however, the system cannot usefully be prescribed in advance but must be permitted to evolve in whatever way conditions make necessary.

There will, of necessity, be a general construction code authority, covering the entire country, and charged with the duty of administering the master code and adjusting questions arising between the divisional or supplemental code authorities. Similarly, there will be a control committee or code authority for each division, administering its supplemental code and adjusting all questions internal to its operations. These country-wide committees will also be the responsible agencies in respect to gathering statistical information on operations in their field, reporting to the Administrator, dealing with required code amendments and the like. Further, they have the general duty of carrying on a continuing study of the industry and suitable methods of dealing with its problems of government, as specifically required by the Recovery Act.

Within each division, the extent and detail of administrative organization clearly will depend on its individual necessities. The extent to which state, regional and local organizations of the divisional industries will have to be established to make an effective government system for that functional group will doubtless be different for the different divisions, according to the size of unit operating in the field and the spread and character of its work. The importance of the locality factor must be remembered here. The construction industry already recognizes certain economic unit areas. Under the authorization granted by the code, it will doubtless continue to recognize these areas and, in addition, recognize as many others as seem necessary.

No apprehension need be felt at this time concerning the detailed development of the administrative system, for its working out will follow lines of effort already well established in the construction field. It is wholly reasonable to expect that immediately upon promulgation of the code the local and national groups will adapt their operating organizations to their provisions. The important point to bear in mind is that the codes place all members of an industry or subdivision on a par, making all of them subject to majority agreements and placing all of them under control of the newly established or delegated governing authority, regional or local. Application of this principle permits for the first time an effective regulation and sanitation of construction practices, and marks the beginning of the course toward industrial stabilization. At the same time there is adequate protection against dictation or monopoly in any functional division or in any locality, through group coordination both locally and nationally, as well as, finally, through the overhead control functions of the NRA.

Difficulties and outlook

As already noted, the code work has taken three months to its present point of near completion. There have been some expressions of question or concern over what seemed to many people unduly long delay in completing the code work. It is therefore fair to say that the principal difficulty that the code committee has encountered during this protracted discussion has been that of bringing the numerous separate groups of construction together in an understanding of the fact that they have a common interest and must of necessity cooperate if the desired results are to be obtained.

The remaining difficulty of importance is agreement upon mutually satisfactory wage and hour conditions, which, as stated, are still in negotiation. Progress here depends upon practical recognition of the fact that any radical change in

labor conditions will increase construction costs to the point of inhibiting all private enterprise and reducing construction activity to the relatively modest total of public works.

What of the future? The code committee and all who have had contact with it well understand that the Recovery Act expires in little more than a year and that the code system as a recognized piece of governmental machinery expires with it. But all recognize just as clearly that integration and self-government of construction are imperative necessities, that the industry cannot expect to lead other than a precarious unhealthy existence without such self-regulation and control as the present movement embodies. All the work of the code committee, therefore, has been guided by the thought of making it effective in 1935 and beyond. Permanent unification and permanent health of construction, to enable our activities to fit most completely into the economic interest of the nation as a whole, are the true aims of the new constitution which construction has written for itself.

Code Making and Administration

By James W. Follin

Secretary, Construction Code Committee, Construction League of the United States, Washington, D. C.

ALTHOUGH tentative drafts of many of the construction codes have been published and news of their progress has been reported from week to week, many engineers and contractors are not familiar with the code-making procedure. The present article, in sketching a comprehensive picture of the work, indicates how the master code ties together the various supplemental codes of fair competition, and also explains the mechanism through which the codes will be administered. —EDITOR.

THE National Industrial Recovery Act imposes certain conditions upon all industry. It provides for the submission of codes of fair competition by representative trade associations to govern all who operate in a particular industry; but where voluntary codes are not submitted or approved, the President may ordain a code of fair competition for a particular industry and place the members thereof under governmental license. Accordingly, all employers everywhere will be subjected eventually to certain restraints, including most importantly the establishment of minimum wages and maximum hours of employment, designed to increase purchasing power and reduce unemployment.

Early efforts at code drafting

Several of the national trade associations in the construction field undertook the preparation of codes for their divisions of the industry very early in the game, in one or two cases even before the approval of the National Industrial Recovery Act. However, as the NRA expanded its organization to meet ever-increasing demands, tentative drafts of codes began to pour in, and it became apparent that there would be 57 varieties of codes concerning construction operations. It was at this time, about the middle of July, that conferences between leaders in the construction industry and the NRA determined the desirability of coordinating all codes for construction through a master code to which all divisional codes should be supplementary. This was the inception with NRA of the master or basic code idea, which subsequently has been applied to many other industry groups.

As a result of these conferences, the Construction League of the United States stepped forward and offered to become the sponsor for a master construction code. On July 26 the policy committee of the league officially accepted the responsibility and appointed a code committee to prepare and present a master code and to coordinate the necessary sub-codes. The personnel of this code committee has an occupational experience in construction which reaches into all activities of the industry.

Coordination of codes

The chart, Fig. 1, visualizes the function of the code committee as interposed between the groups proposing codes and the NRA. Without such a coordinating agency the many lines shown at the bottom of the chart would all have poured into NRA and imposed an unreasonable burden on the recovery officials. In order to assist in straightening out these overlaps, the code committee created an advisory council of accredited representatives and alternates appointed by national professional bodies and trade associations, to advise with respect to the provisions of the master code and matters of policy, and to keep it in touch with construction code questions and progress.

Within the first week the code committee had drafted a tentative master code, held a two-day meeting of the advisory council for criticism of this draft, submitted its proposed code to the NRA and held a preliminary hearing, or preview, with the NRA. Within the space of a second week it had secured approval by the Administrator of substitutions from the code as submitted into the PRA (President's Re-employment Agreement) and arranged for the holding of a public hearing on Sept. 6 on the master code and nine supplemental codes. Since Sept. 6 public hearings have been held on seven other supplemental codes, and one has already been scheduled for the week of Oct. 30.

The close relationship of the code committee to the code activities of the national trade groups and professional bodies is depicted in Fig. 2. The league, its code committee, its master code, and finally its code authority, form the axis of the industry, and at each step tie in with similar activities of the divisional groups. All lines lead into the NRA, from which authority for code administration flows through the Construction Code Authority to the code authorities for the divisional groups.

Power to prepare a code for a particular division of the industry springs initially from individual employers who are members of a national trade association and results eventually in the imposition of regulations to govern the activities of these employers *and also employers who are not members.* Thus the circle is completed.

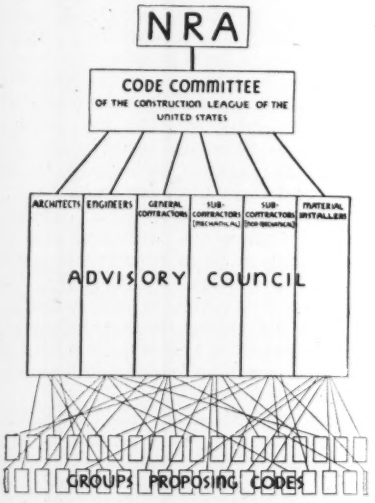


Fig. 1—The code committee with its advisory council, being interposed between the groups proposing codes and the NRA, acts as a necessary coordinating agency to reduce the work required of the NRA officials.

Preparing and administering codes

Through the procedure fixed in the constitution and bylaws, the members of the national trade association authorize that national association to undertake the preparation of a code. The code committee to which this task is delegated then prepares the supplemental code and presents it to the NRA. The NRA investigates the purported representative character of the national trade association and its authority to speak for the majority of the industry, and, if satisfied as to this representative character, it reviews the provisions of the proposed code at a preliminary hearing or preview with the code committee, called by the Deputy Administrator, at which representatives from the labor, consumer, and industrial advisory boards of the NRA and of the legal and planning and research divisions are present. Usually this preliminary conference results in further revision of the code as

submitted and its printing for public hearing.

The public hearing is the opportunity for all to be heard as to the prosopals in the code. These hearings are "solely for the purpose of obtaining in the most direct manner the facts useful to the Administrator, and no arguments will be heard," but briefs may be presented. Following the hearing, the labor, consumer and industrial advisory board representatives and the legal, planning and research divisions make reports to the Deputy Administrator in charge of the code; the code is then rewritten in accordance with the various suggestions and amendments proposed, and is resubmitted to the code committee. As finally determined upon in conference, it goes to the Administrator and eventually to the President for approval.

Upon approval of a code the code authority therein provided for is appointed, and on the effective date of the code it assumes the responsibility for administration, subject to the NRA.

Construction industry organization

It is recognized that construction is by and large a local industry, and that the administration of codes therefore must be delegated to properly representative local groups in each division of the industry. These local code-control committees might very logically tie together and coordinate their individual efforts, in the interests of both economy of administration and effective solving of local problems. But all such local committees will be responsible to their respective national code authorities. The construction code authority at the top will constitute the final appeal body within the industry, but appeals from its decisions may be taken by any interested party to the Administrator.

At the present time local codes are not contemplated as a separate part of the system of construction industry codes. All members of a particular division of the industry in a locality will be bound by the regulations of the national code for that division. Should they wish to operate under a more detailed procedure not inconsistent with the national code, possibly local rules and regulations may be approved by the national code authority to which they are subject.

Fig. 3 compares code administration with the sponsorship of codes as previously described. A fairly definite line of demarkation exists between these two subjects, but they are joined together by lines of appointment from the national trade association to the code authority established by the code. The code authority, once established, is responsible to the NRA rather than to the national trade association which brought it into being. But the national trade association or professional body assumes even a more important function under code administration than previously. As the foster parent, it must see that its offspring is afforded full-fledged cooperation by members of the industry, and

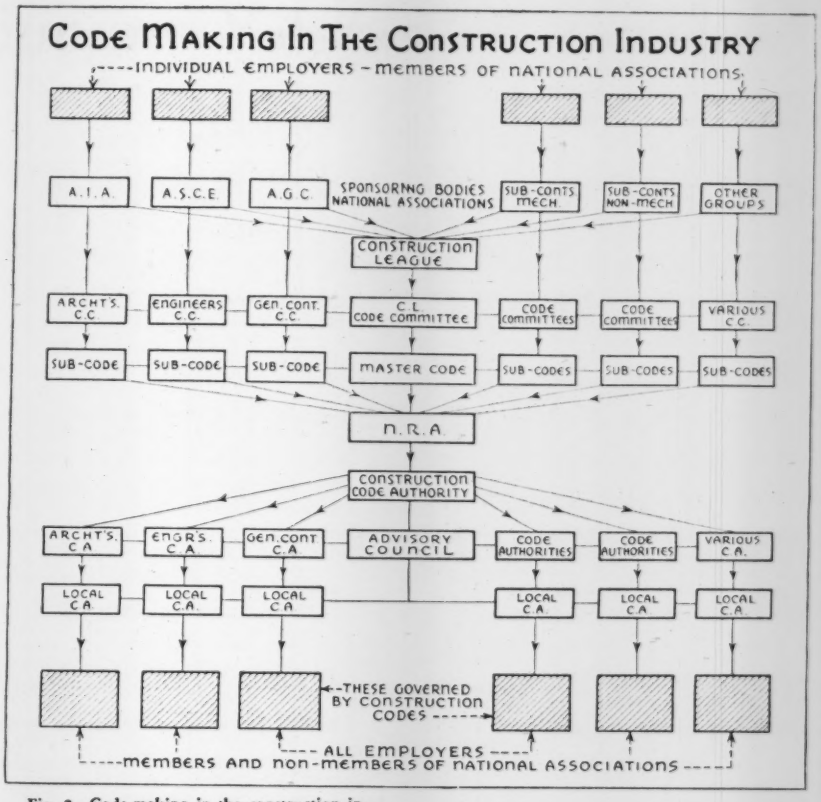
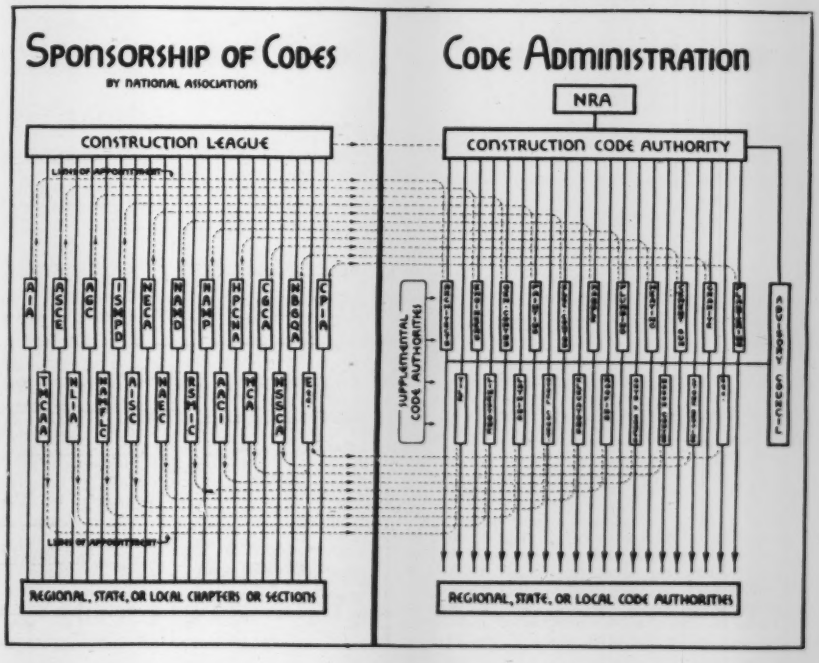


Fig. 2—Code-making in the construction industry charted to show how the activities of all code-drafting agencies flow into the NRA and how administrative authority flows out of NRA to all construction employers.

that it does not become unresponsive to changing conditions in the industry or bureaucratic in its decisions. The national trade associaton must still carry on its many activities in the interest of its members, in legislation and other directions, which will proceed more effectively if not confused with code administration. All of this is in the direction of a more intelligent conduct of the country's second largest industry.

Fig. 3—Comparison of sponsorship of codes with responsibility for their enforcement shows the intimate relation between the national trade associations and the various code authorities.



Economy Through Continuity in Girder-Beam Bridges

For three-span bridges more than 120 ft. long, Nebraska highway department effects saving through use of continuous beams—Design factors outlined

By Josef Sorkin
Bridge Designer, Nebraska Dept. of Roads and Irrigation, Lincoln, Neb.

THE DEVELOPMENT of deep-rolled I-beam sections, often referred to as girder beams, has considerably simplified the design and construction of bridge spans of moderate length. These sections are rapidly replacing the pony truss because of economy in metal and simplicity in fabrication and erection. They are particularly useful for skew bridges, for which pony-truss designs are complicated and expensive. These advantages, applicable to simple spans, are even greater when continuous designs are used, and within the last few years a number of continuous girder-beam bridges have been constructed in the United States.

The advantage of a continuous design over a simple-span design is purely that of economy, manifested in two principal ways: (1) The material is used more efficiently, and (2) the allowable stresses need not be reduced due to the relative shallowness of a beam in longer spans. Specifications for simple-span I-beam bridges require that the depth of the beam be at least one-twentieth of the span length. The requirement is presumably based on dead-load deflection. When this condition cannot be met, the allowable stresses are reduced in proportion—that is, if the allowable stress for steel is 24,000 lb. per sq.in. and a 36-in. beam is used for an 80-ft. span, the allowable stress in the beam would be reduced to $\frac{36}{48} \times 24{,}000$, or by 25 per cent.

It can be shown that the dead-load deflections in a symmetrical continuous three-span bridge are much less than the deflection in a simple span equivalent to the longest of the three continuous spans. Thus, if

L = length of simple span (see Fig. 1) and also the length of the central span in the continuous bridge,
w = dead load in lb. per unit length,
E = modulus of elasticity in lb. per sq.in.
I = moment of inertia.
n = ratio of approach span to center span in the continuous beam.

The dead-load deflection for the simple span $= \frac{5wL^4}{384EI}$ In the central continuous span the deflection $= \left[\frac{5}{384} - \frac{1+n^3}{32(2n+3)}\right]\frac{wL^4}{EI}$

For $n = 1$, in which case all spans of the continuous beam would be equal, the deflection in the center of the central span would be $\frac{wL^4}{1920EI}$ or actually 1/25 of the deflection in the simple span. In the extreme case when $n = 0.5$, the length of the approach span would be half of the central span, and the deflec-

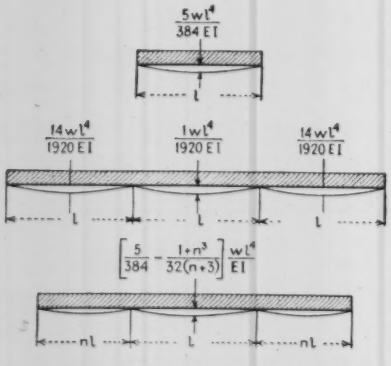


Fig. 1—Comparison of deflections for simple and continuous beams under the same uniform load.

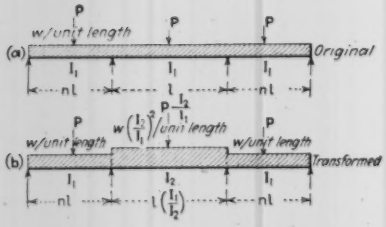
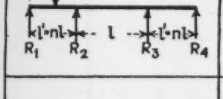
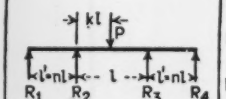
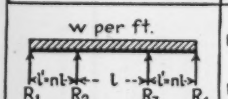
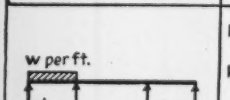
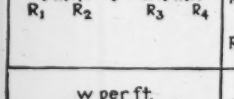


Fig. 2—When a heavier section beam is required in the center span than in the side span, computations are simplified by transforming the loads and length of the center span in the ratio of the relative moments of inertia and proceeding on the basis of the constant moment of inertia for the three spans.

Fig. 3—Moments, reactions and shears for beams continuous over three spans of variable length.

$M_1 = M_4 = 0$ Constant I $x = 4n^2 + 8n + 3$

LOADINGS	REACTIONS	MOMENTS
	$R_1 = P(1-k) - \frac{2n(1+n)}{x} P(k-k^3)$ $R_2 = Pk + \frac{n(n+2)}{2n+3} P(k-k^3)$ $R_3 = -\frac{n(1+n)}{2n+3} P(k-k^3)$, $R_4 = \frac{n}{x} P(k-k^3)$	$M_2 = -\frac{2n^2(n+1)}{x} Pl(k-k^3)$ $M_3 = \frac{Pln^2(k-k^3)}{x}$
	$R_1 = -P\frac{2(n+1)(2k-3k^2+k^3)-(k-k^3)}{nx}$ $R_2 = P(1-k)+P\frac{(2+n)(2k-3k^2+k^3)-(1+n)(k-k^3)}{n(2n+3)}$ $R_3 = Pk-P\frac{(1+n)(2k-3k^2+k^3)-(2+n)(k-k^3)}{n(2n+3)}$ $R_4 = P\frac{(2k-3k^2+k^3)-2(n+1)(k-k^3)}{nx}$	$M_2 = -Pl\frac{2(n+1)(2k-3k^2+k^3)-(k-k^3)}{x}$ $M_3 = +Pl\frac{(2k-3k^2+k^3)-2(n+1)(k-k^3)}{x}$
	$R_1 = R_4 = wl\left[\frac{n}{2} - \frac{n^3+1}{4n(2n+3)}\right]$ $R_2 = R_3 = wl\left[\frac{1}{2} + \frac{n}{2} + \frac{(n^3+1)}{4n(2n+3)}\right]$	$M_2 = M_3 = -\frac{(n^3+1)}{4(2n+3)} wl^2$
	$R_1 = wl\left[\frac{n}{2} - \frac{n^2(1+n)}{2x}\right]$ $R_2 = wl\left[\frac{n}{2} + \frac{n^2(n+2)}{4(2n+3)}\right]$ $R_3 = -\frac{wln^2(1+n)}{4(2n+3)}$ $R_4 = wl\frac{n^2}{4x}$	$M_2 = -wl^2\frac{n^3(n+1)}{2x}$ $M_3 = wl^2\frac{n^3}{4x}$
	$R_1 = R_4 = -\frac{wl(2n+1)}{4xn}$ $R_2 = R_3 = wl\left[\frac{1}{2} + \frac{1}{4n(2n+3)}\right]$	$M_2 = M_3 = -wl^2\frac{1}{4(2n+3)}$

tion would be $\frac{13wL^4}{3072EI}$ or practically one-third the deflection of the simple span. A general formula for the deflection in the approach spans would be rather involved, but for each individual case it can be figured easily. It may be pointed out, however, that in three equal continuous spans the deflection in the approach spans is approximately $\frac{14wL^4}{1920EI}$ or only about one-half the deflection in a simple span of equivalent length. Of course, with the increase of the central span and corresponding decrease in the approach spans this deflection will decrease. In other words, the continuous beam may be subjected to greater loads, or its span may be lengthened considerably under the same loads before the deflection becomes as great as that of a simple beam. Consequently, there is seldom a case where the allowable stresses need be reduced due to excessive deflection.

The general features of design may be considerably simplified by resolving the well-known theorem of three moments into factors, as shown in Fig. 3. Further simplification may be obtained by constructing charts based on the same factors. The accompaying table shows a few design for various bridge lengths.

Generally it will be found that a small variation of moment of inertia of the beams in the spans will not vary the computed stresses to any appreciable degree. Furthermore, the appearance of the structure as well as complications in splicing beams of unequal depth make it desirable that beams of uniform depth should be used. However, the use of sections of different weights may at times be warranted; and if there appears to be a considerable variation in the moments of inertia, it is advisable to check the computed stresses for this variation.

TYPICAL THREE-SPAN CONTINUOUS GIRDER BEAM BRIDGE DESIGNS
H-15 loading; 5 ft. 1 in. beam spacing; 7½ in. concrete slab and constant moment of inertia

Length of Bridge, ft.	Length of Spans	Length of Beams, ft.	−M 1,000 ft.-lb	+M 1,000 ft.-lb	S In.³	Beam
100	33′4″ 33′4″ 33′4″	42 16 42	277.7	309.3	154.7	24″x 70
	28′6″ 43′0″ 28′6″	36 28 36	317.0	321.5	160.8	24″x 70
	26′6″ 47′0″ 26′6″	34 32 34	346.0	355.5	177.8	24″x 74
125	35′6″ 54′0″ 35′6″	45 35 45	452.0	438.5	228.5	28″x 85
	33′6″ 58′0″ 33′6″	44 37 44	492.5	470.6	246.3	28″x 91
	32′0″ 61′0″ 32′0″	42 41 42	524.5	485.0	264.0	28″x 97
150	47′6″ 55′0″ 47′6″	59 32 59	528.0	441.4	264.0	28″x 97
	44′6″ 61′0″ 44′6″	56 38 56	587.5	517.0	293.8	28″x104
	42′6″ 65′0″ 42′6″	54 42 54	622.5	545.5	311.3	30″x108
	41′6″ 67′0″ 41′6″	53 44 53	648.0	574.0	324.0	30″x115
	40′0″ 70′0″ 40′0″	52 46 52	680.0	615.5	358.0	30″x122
	37′6″ 75′0″ 37′6″	50 50 50	747.5	680.5	385.0	33″x125
200	62′6″ 75′0″ 62′6″	78 44 78	902.0	678.0	456.0	33″x141
	57′6″ 85′0″ 57′6″	73 54 73	1017.0	831.0	508.5	36″x150
	56′6″ 87′0″ 56′6″	72 56 72	1048.0	895.5	541.0	36″x158
274	86′0″ 103′0″ 86′0″	107 51 107	1694.0	1231.0	847.0	36″x230

Note: Lengths of beams as shown in these tables will provide splices at points of inflection for D. L. moment. However, no serious defect will be introduced if a change in beam lengths will move the location of splices anywhere between the points shown and midway to the nearest support.

The several well-known methods for calculating stresses in continuous beams of variable moments of inertia are quite involved. For a symmetrical arrangement of spans, as presented here (that is, indentical beams in the end spans but with a different section in the central span), stresses may be recomputed by a simple arithmetical method. After making preliminary computations, using a constant moment of inertia and selecting the required beam sections, the procedure is as follows (see Fig. 2):

Let L = length of central span
nL = length of approach spans
I_1 = I of approach spans
I_2 = I of central span
w = uniform load
P = concentrated load

Fig. 2*a* shows the basis for the preliminary computation of stresses. Fig. 2*b* shows the actual effect of the variation of moment of inertia. That is, for the purpose of computing the true stresses, the central span should be transformed into an imaginary length $= \frac{LI_1}{I_2}$; the uniform load w on the central span into $w\left(\frac{I_2}{I_1}\right)$ and the concentrated load P into $P\frac{I_2}{I_1}$. It should be noted that the length and loads on the approach spans remain as in Fig. 2*a*. After these adjustments have been made, the stresses may be computed on the basis of a constant moment of inertia of the beam. (This method was suggested by I. Oesterbloom in "Continuous Beams Over Three Spans." *Transactions*, Am.Soc.C.E., 1929).

The fact that beams are generally spliced beyond the supports and that the variation of the moment of inertia differs somewhat from the assumed conditions throws but a very insignificant error into the recomputed stresses.

The influence lines, shown in Fig. 4, indicate the necessary application of live loads for maximum stresses. Very little economy will be found in the use of continuous spans in bridges less than 120 ft. long. On the other hand, the longer

Fig. 4—Typical moment, reaction and shear influence lines for three continuous spans.

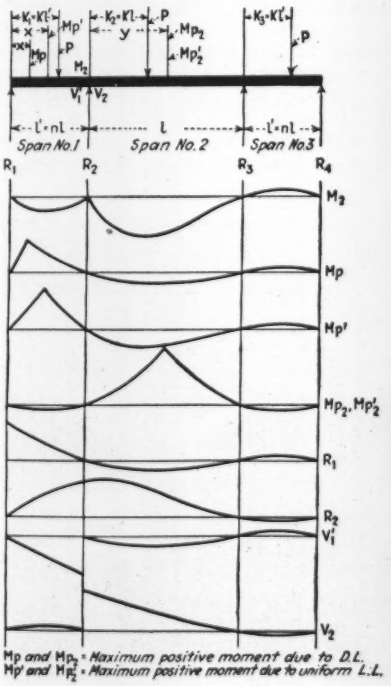
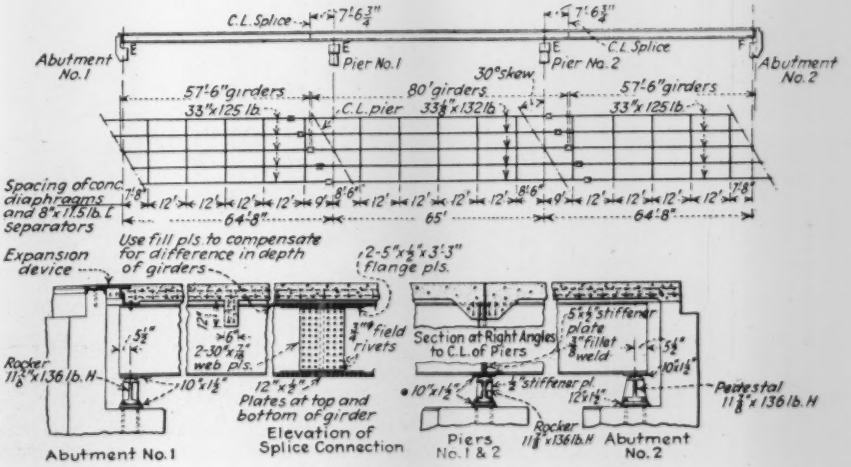


Fig. 5—Details of three-span continuous girder-beam bridge over White River near Harrison, Neb.



the bridge and the longer the spans the greater the economy.

As an example of the saving resulting from the use of continuous beams in longer spans, the three 65-ft. continuous-span structure designed for the Nebraska highway department, shown in Fig. 5, may be cited. If simple spans had been used, 36-in.x167-lb. beams would have been required. Instead, 33-in.x125-lb. and 33-in.x132-lb. beams in the approach spans and central span respectively were used, resulting in a saving of 48,000 lb. of steel, or nearly 25 per cent of the cost of the steel in the superstructure.

Very little additional economy can be derived from continuity of more than three spans, and the complications in providing for the expansion and contraction of unduly long beams suggest that in multiple-span bridges groups of three continuous spans are desirable.

The writer wishes to acknowledge his appreciation to J. G. Mason, bridge engineer, Nebraska Department of Roads and Irrigation, for permission to use office material, and to Professor H. G. Kesner, University of Nebraska, and H. G. Schlitt, assistant bridge engineer, for checking the formulas and computations.

Continuous Truss Utilized for Missouri River Bridge

Three-span structure built by Montana highway department shows close agreement between reactions that are obtained by calculations and by field-weighing with jacks

By William Bertwell
Chief Draftsman, Bridge Department, Montana State Highway Commission, Helena, Mont.

A THREE-SPAN continuous-truss bridge, the first of its type on the Montana state highway system, was completed and opened to traffic on Aug. 15. The structure crosses the Missouri River near Wolf Creek on the scenic highway between Helena and Great Falls. When the design was being made in the bridge department of the highway commission, it seemed probable that the structure could be made symmetrical in appearance, and, when foundation exploration disclosed that a very hard metamorphic shale extended entirely across the stream at a shallow depth, the continuous-truss type was chosen as being most esthetic for the location, within the bounds of economy. The west bank of the river at the bridge site consists of silt for a depth of about 12 ft. to the top of the shale, while the east end of the bridge rests on a point of hard sandstone. Consequently the east approach to the main structure was made a U-abutment with counterforted or cantilever walls, while the west approach was constructed as a 21-ft. concrete deck girder span. In order to duplicate the east abutment in appearance, the outer girders of the west approach were extended downward as curtain walls to below the fill slope line.

The trusses are of the Warren type, 450 ft. long, and consist of twenty panels of 22½ ft. The end spans ar 135 ft. and the center span 180 ft. lon Portals carry the top lateral system o each span independently, while the bo tom laterals are continuous throughou Verticals at the even-numbered pan points are swaybraced. The spa lengths and truss depths made it po sible to use the same chord sectio throughout, two 12-in. 20.7-lb. channel for the bottom chord, and the sam section with a 15-in. $\frac{7}{16}$-in. coverplat for the top chord. The diagonals ar two channels laced, flanges turned out Verticals are 8-in. rolled or built-up I sections. The trusses are fixed at on intermediate pier, and rocker shoes ar provided at other supports. The desig calculations were based upon the actua dimensions and sections of the truss members.

The trusses were erected on timber falsework and completely riveted up before the blocking was removed, in order to minimize variations from the full continuity assumed in the design. The only drifting of truss connections was that necessary to rivet the top-chord section over the pier between the center and west spans, U13-U15. Even this drifting was less than $\frac{1}{32}$ in.

Because of reported experience in a neighboring state, indicating that design assumptions were not likely to be very closely realized in the finished structure, it was decided to weigh the reactions. For convenience in carrying out this procedure, the weighing was done with all steelwork, excepting hand-rails, riveted in place, but before any of the concrete deck was placed. The necessary equipment for the weighing operations, rented from the Oregon highway department, consisted of four jacks with heads, two pumps, two pressure manifolds and four pressure gages. This equipment permitted a complete set-up at two piers at the same time. Two gages were used at each point as a check. The gages were graduated to 20 lb. per sq.in., and the area of the jack pistons was 77 sq.in., so that one division on the gage represented a

Continuous-truss bridge 450 ft. long over the Missouri River north of Helena, Mont.

change in load of 1,540 lb. The final averaged results (in lb.) were as follows:

	L0	L6	L14	L20
Measured....	30,250	102,500	113 350	29,600
Calculated....	27,700	109,800	109,300	28,500

The calculated reactions are not perfectly symmetrical because of differences in men and equipment on the structure during the jacking operations, and also because of the difference in weight of the fixed shoe lifted at L6 and the rocker lifted at L14. The variation between the reaction measured at L6 and that measured at L14 is not explainable except by attributing a large part of the discrepancy to inaccuracy in the weighing equipment, since the structure would not be in static equilibrium under the reactions actually measured, although the sum of the four reactions calculated and measured is about the same. A drift of $\frac{1}{32}$ in. in the member U13-U15 would result in only 180 lb. increase in reaction at L0, 1,050 lb. decrease at L6, 1,840 lb. increase at L14, and 970 lb. decrease at L20. The largest of these changes is only slightly more than one division on the pressure-gage dial, whereas the probable error in the measured values must be 4,000 or 5,000 lb., representing about three divisions on the dial. The error, however, is negligible in magnitude, since the calculated full dead-load reaction at the ends is 83,800 lb. and at the intermediate points 308,100 lb. Hence, no further effort was made to locate the source of the error, and the results were considered a close check of the design.

Another interesting check was of the calculated change in reaction for a 1-in. deflection of the reaction point. It was calculated that an end reaction would increase 6,400 lb. when jacked up 1 in., and an intermediate reaction 26,300 lb. The gage reading increased just about 80 lb. per sq.in., equivalent to a reaction change of 6,200 lb. when the end was jacked 1 in., and about 350 lb. per sq.in., representing a change of 26,900 lb. when an intermediate point was jacked 1 in.

The reactions on the two shoes at each pier were also checked and found to be the same in every case.

Final quantities and cost of the structure were as follows:

	Quantity	Cost
Structural steel, lb.	538,306	$27,992
Cast steel, lb.	10,582	1,058
Reinforcing steel, lb.	78,620	3,341
Class D concrete (about 1:2:3), cu.yd.	361.2	6,862
Class A concrete (about 1:2:4), cu.yd.	543	9,774
Excavation, cu.yd.	515	3,605
Cast-iron floor drains	40	120
Roadway approach fills, cu.yd.	789	260
Total		$53,012

The contract for the bridge was let to the W. P. Roscoe Co., of Billings, Mont., on Nov. 4, 1932. Plans and construction for the entire project were under the direction of B. J. Ornburn, bridge engineer for the highway commission. H. H. List was resident engineer for the state. The contractor's foremen were H. E. Girdwood, for concrete work, and J. A. Peltzer, structural-steel erection. The writer was in charge of the preparation of the design and drawings.

New Incinerator at Toronto Has Straight-Line Layout

THE OPERATION of two existing refuse-disposal plants at Toronto, Ont., permits the incineration of 70 per cent of the garbage and combustible refuse collected. The remainder is deposited at tips (to use the Engilsh term for refuse dumps), which, however, are not "controlled" as are those in England. They are rather unsightly and are used at all times by private parties for the disposal of various classes of refuse. Due to this condition and to the diminishing areas available for dumping purposes, a third high-temperature destructor was projected last year and is now rapidly nearing completion.

This new destructor is of the crane-operated type and will be erected at an approximate cost of $500,000, with a rated capacity of 500 tons per 24 hours. Many new features are incorporated in the design and furnace arrangements. The vehicles enter the receiving floor, which is slightly above grade, and discharge the refuse into a receiving pit 124 ft. in length, 15 ft. wide and 18 ft. in depth. The refuse will be elevated by two traveling electric cranes, each bucket having a capacity of 2 cu.yd. The maximum lift will be 45 ft. The refuse is deposited in receiving hoppers over the charging containers and discharged through the hopper doors to the furnace. The hopper doors and feed-hole covers are mechanically operated by compressed air.

There are four furnaces, each having four cells or grates with a grate area of 120 sq.ft., which includes the surrounding casting. A drying hearth, 33 in. in width, is provided at the rear of the grates. A feed hole is provided over each cell in the arch over the furnace chamber. Each cell will have an individual ash pit and ash hopper provided with separate draft control and will be separated above the grates from the adjoining cell for a distance high enough to permit separate and individual stoking and fire cleaning of each. The dumping grate section of each cell will be 16x36 in., operated by means of a worm-gear mechanism at the furnace front. The ash hoppers are of sufficient size to hold at least two full grates of residue.

The necessary draft for combustion will be supplied by a direct-connected electric-motor-driven centrifugal fan (one fan and one motor for each furnace). Each will have a capacity of 10,000 cu.ft. per minute.

Two expansion chambers are provided from the main flues of the furnace, connecting to the chimneys. Each is provided with a baffle wall and dust pockets to prevent the escape of live sparks or other objectionable material from the chimneys.

One complete regenerator will be provided for each furnace, flue gas being bypassed at a point in the combustion chamber through the regenerator and controlled by a damper. The regenerators will be constructed of cast-iron plates and lap-welded steel tubes 5 in. in diameter and 6 ft. in length, built up in sections so that renewals will be possible. The entire structure of plates and tubes will be incased in a steel housing of plates $\frac{1}{4}$ in. in thickness. The arrangement is such that tubes and surface plates can be readily cleaned and the tubes withdrawn. The passage of flue gas will be from top to bottom on the inside of the tubes. The air for combustion will be forced to circulate through the regenerator on the outside of the tubes.

Two radial-brick chimneys with concrete foundations are provided, with independent fire-brick linings for the full height of the chimney. The height of the chimneys from the top of the foundations is 175 ft., with an internal diameter of 120 ft.

The layout of the furnaces, combustion chambers and regenerators is a departure from the conventional layout in that all furnaces, cells and combustion chambers are arranged in a straight line. In this design the four furnaces are in two pairs, each pair back to back, separated by a pasageway 4 ft. wide. The over-all length of the four furnaces is 86 ft. The two central furnaces facing each other are separated by a distance of 30 ft., providing a stoking aisle of 15 ft. The stoking aisle for each outside furnace is also 15 ft. The furnace arrangement permitted the construction of a much smaller building, thereby reducing the cost considerably.

The plant is located on property that was formerly a sand and gravel pit. There was sufficient table land for building purposes, and the excavated area will provide for the disposal of the ash residue from incineration for a period of three years

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Abstract of a paper presented to the International Association of Public Works Officials, Sept. 21-23, at Milwaukee, Wis., by Harold D. Bradley, deputy street commissioner, Toronto, Ont.

Soil-Bearing Tests for Columbus Water Tanks

Settlements of test columns and foundations harmonize closely—Soil yield-point plainly shown

By John C. Prior
Professor of Sanitary Engineering, Ohio State University, Columbus, Ohio

THE soil-bearing tests that are described here for two large elevated water tanks at Columbus, Ohio, should be of interest and value to engineers who design or build foundations. Additional evidence is presented pertinent to the question of the relative settlement of small and large bearing areas subjected to like unit loads.

An engineer having before him the results of a preliminary small-scale soil-bearing test may be greatly perplexed when charged with the responsibility of fixing therefrom a safe, yet economical unit design load for the foundations themselves. This is true because his literature will likely declare that "A small area will bear a larger load per unit of area for a short time than a larger area perpetually"[1], or that "Large areas of compressible ground will not continuously support as large a unit load as a smaller area for a short time"[2] without giving any hint of a numerical relation between the great and little areas. This perplexing situation arises because no definite relationship has yet been proven.

No attempt at answering this question will be made herein, but some recent attempts to do so by others will be briefly discussed, and the Columbus test results will be exhibited in sufficient detail to permit one to judge of their merits.

Foundation conditions

The two tanks are located on the crest of the same divide and are about 1½ miles apart. The tank to the north, which has a capacity of 1,021,000 gal., is located on moderately firm blue-black clay soil containing occasional boulders. Below the top soil the clay is quite uniform in character throughout the depth investigated. The groundwater is uncommonly high at all times. While making the test the water table was 2 ft. under the ground surface, and this level was lowered only 6 in. during an unusually dry summer.

The southerly tank (*ENR*, Feb. 25, 1932, p. 279) has a capacity of 2,004,000 gal. and is located on very firm yellow clay, with numerous boulders and a little sand. In the foundation excavations two or three small sand pockets were encountered, but none was in the immediate vicinity of the test pit. The groundwater at the time of the test was more than 10 ft. below the ground surface. The clay, however, contained enough water to render it more or less impervious to further moisture. The excavations held rain water for days without penetration enough to change materially the character of the soil for a depth of more than an inch or two.

Method of testing

At each site a test hole was excavated of the depth and shape shown in Fig. 1. It will be noted that the test pits were dug to two levels and that the test was made upon the higher level or shelf. The purpose of the deeper excavation was to reveal the character of the soil some distance below the test level. It is thought that the tests were carried out at a sufficient distance from the shelf edge to render the deeper portion of the hole impotent in affecting test penetrations. The vertical wall of the shelf at each pit remained perfectly stable during the tests.

The loads were applied to the soil through an 8x8-in. oak column having a bearing area of 0.4 sq.ft. Timbers placed across the pit held the column in a vertical position. These guides were arranged so that they did not affect the load. Weighed lead pigs were placed upon the platform at the top of the column to produce the desired load increments. The empty apparatus produced an initial load of 1,750 lb. per sq.ft. The penetrations were carefully measured by an experienced engineer who used a Y-level working from an adjacent benchmark set in concrete. The readings were taken to thousandths of a foot, but the equipment was such that the results can not be regarded as accurate to less than a half-hundredth.

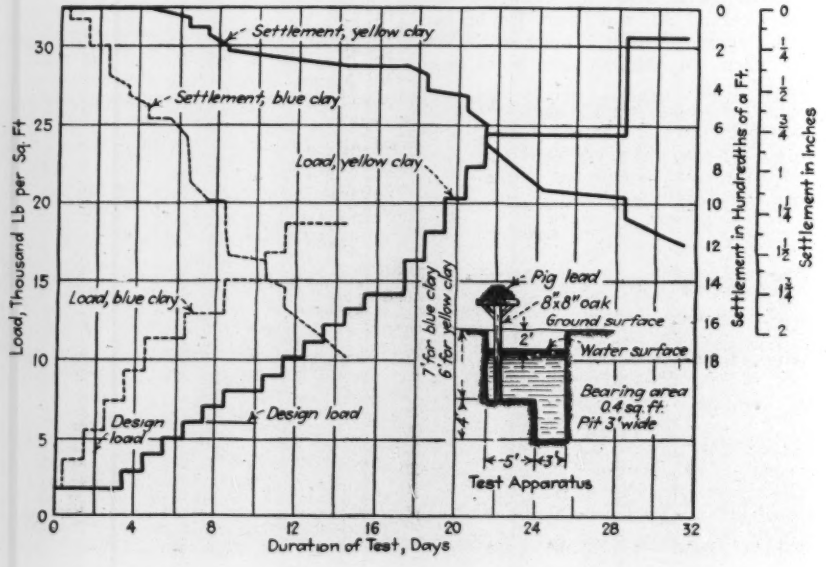
Just before setting up the test apparatus the bearing area was carefully excavated to a level surface into undisturbed soil. Groundwater at the 1,000,000-gal. tank site quickly filled the pit to a point 2 ft. below the ground surface which level remained constant through the 15-day test period. At the 2,000,000 gal. tank site the pit was filled with water from a near-by hydrant to a like level. The soil was so impervious that the water needed to be replenished but twice during the 32-day period of the test, and then the water surface receded only a few inches between each replenishment.

After completing each test, the soil under the bearing column was excavated to make sure that it was similar to that exposed in other parts of the pit and especially to demonstrate that no large boulder was affecting the bearing capacity. These excavations revealed no unusual conditions.

Results of tests

The data gathered from the preliminary test pits are shown graphically in Figs. 1 and 2. The curves labeled blue clay refer to the pit at the site of the 1,000,000-gal. tank, and those labeled yellow clay to the 2,000,000-gal. tank site. The stress-strain curves (Fig. 2), besides showing measured penetrations plotted against corresponding units loads, show the writer's notion of how these curves ought to be smoothed out to facilitate interpretation. The smoother curves enable one to estimate the penetration of the empty ap-

Fig. 1—Time-load settlement diagram as determined by load-testing device illustrated.



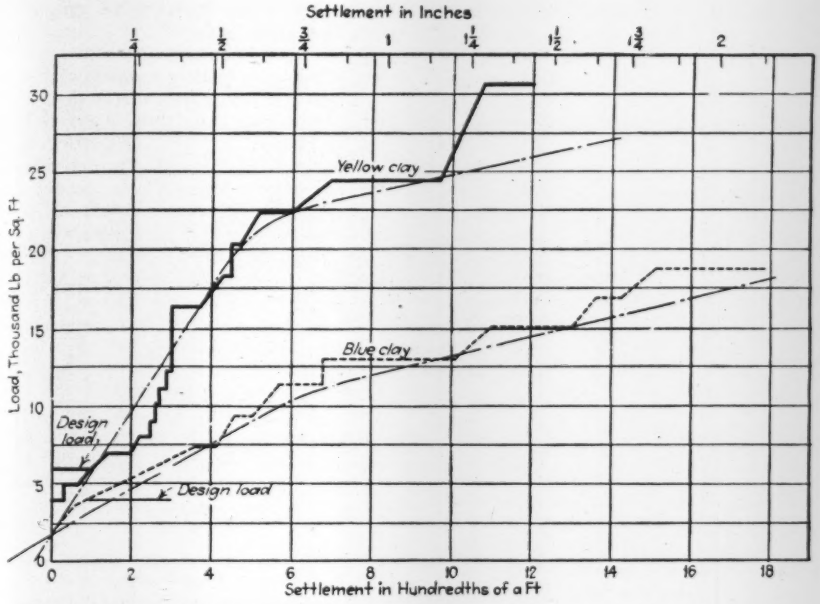


Fig. 2—Stress-strain diagram, showing measured penetrations plotted against unit loads.

paratus more closely; they bring out more clearly the yield or fluidity point, and finally they probably compensate some of the errors of observation, especially at the lighter loads. The yield point of the blue clay is plainly in the vicinity of 10,000 to 11,000 lb. per sq.ft. of soil pressure.

The selection of a 2-ton working load for blue clay was largely influenced by the fact that it gave a conservative safety factor, namely 2½, with respect to the yield point, and the further fact that the corresponding indicated settlement was small, namely less than ⅛ in.

TABLE I — SETTLEMENT OF PIERS OF 1,000,000-GAL. TANK

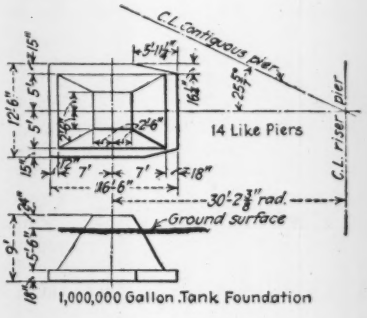
Pier	Elevation Before Tank Erection	Settlement Ft.
1	885.375	.025
2	.37	.02[3]
3	.375	.025
4	.375	.025
5	.38[3]	.025
6	.37	.02[3]
7	.38[3]	.03[1]
8	.37	.03[1]
9	.37	.02[3]
10	.37	.02[3]
11	.37	.025
12	.365[4]	.02[3]
13	.37	.025
14	.375	.03[1]
Average	885.372	.028

[1]Maximum. [2]Minimum. [3]Highest. [4]Lowest.

TABLE II — SETTLEMENT OF PIERS OF 2,000,000-GAL. TANK

Line	Outer Ring of Piers: Elevations, Tank Empty	Outer Ring of Piers: Settlement, Ft.	Middle Ring of Piers: Elevations, Tank Empty	Middle Ring of Piers: Settlement, Ft.	Inner Ring of Piers: Elevations, Tank Empty	Inner Ring of Piers: Settlement, Ft.
1	839.168[1]	.013	839.165	.025[3]	839.155	.016
2	.168[1]	.011	.160	.021	.158	.023[3]
3	.158	.009	.152	.012	.163	.013
4	.165	.009	.173[1]	.018	.153	.013
5	.155	.005	.158	.019	.153	.013
6	.154	.014[3]	.134[2]	.019	.169[1]	.014
7	.144	.012	.159	.014	.159	.009
8	.164	.009	.169	.010	.169[1]	.014
9	.140[2]	.000[4]	.160	.010	.150[2]	.010
10	.145	.005	.147	.007	.156	.011
11	.150	.000[4]	.140	.005[4]	.150[2]	.005
12	.163	.010	.157	.012	.163	.004[4]
Average	839.156	.008	839.156	.014	839.158	.012

[1]Highest. [2]Lowest. [3]Max. [4]Min.



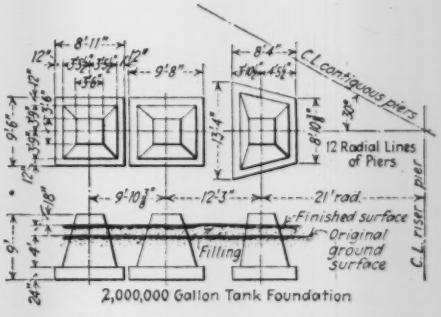


Fig. 3—Foundations for 1,000,000- and 2,000,000-gal. water tanks at Columbus, O.

However, it should be said that some slight apprehension was occasionally experienced when one remembered that the piers to be constructed were nearly 500 times the size of the test block. If increasing the size was to have a pronounced effect upon settlement, the imaginary picture presented was not an inviting one.

As it was proposed to construct the 2,000,000-gal. tank with a semi-flat bottom supported upon continuous girders, it was felt that a more conservative foundation working pressure was demanded. The 3-ton load used for yellow clay shows a safety factor approximating 3½ and an indicated settlement of ⅛ in. Later developments seem to demonstrate that a little timidity was exhibited in this selection and that, with perfect safety, a 4-ton working load could have been adopted.

Design of foundations

The arrangement and sizes of the tank foundations are shown in Fig. 3. In the upper portion of each pier is embedded an I-beam grillage, the planed top of which is flush with the pier top. The elevation of a definitely marked spot on each grillage, located just outside the column base, was taken at the 1,000,000-gal. tank before erection began and after the tank had been standing for several hours with the water surface 5 ft. below the overflow. The initial elevations and the measured settlements are given in Table I.

Similar figures are presented for the 2,000,000-gal. tank in Table II. In this case the first elevations were taken after the erection was completed, and the second ones after the tank had been standing full of water for 18 hours. The groundwater was above the bottom of the footings.

The settlements given in Table I were caused by a superstructure load of 46,100 lb., and a water load of 509,700 lb., or a total load of 555,800 lb. With a footing area of 198.2 sq.ft., this was a unit load of 2,810 lb. per sq.ft. Since the ring piers of a large tank derive most of their burden from the water supported, it is probably safe to assert that the load on such piers can be calculated with greater accuracy than is possible for most other large engineering structures. It is of interest to note that the average observed settlement of the fourteen piers was slightly more than ⅛ in.; whereas, for the same unit load (2,810 lb. per sq.ft.) the indicated penetration of the preliminary test was ¼ in.

The settlements reported in Table II were occasioned by loads estimated as follows:

	Outer Piers	Middle Piers	Inner Piers
Water load, lb.	317,000	476,000	476,000
Area, sq.ft.	84.75	91.75	92.5
Unit load, lb. per sq.ft.	3,740	5,190	5,150

It will be observed that the indicated

penetration from the test curve for 3,700 lb. per sq.ft. is almost exactly the same as the average of the observed settlements of the outer ring of piers. Also, for 5,200 lb. per sq.ft. the test-curve penetration corresponds very closely with the average measured settlement of the middle and inner piers.

Relationship theories

The U. S. Bureau of Public Roads conducted a series of tests to determine the effect of bearing area upon settlement.[3] From these tests it was concluded that when a given unit load is applied to a soil over various areas, the depth of penetration is directly proportional to the square root of the area over which the load is applied. This relationship may be expressed as a formula, thus:

$$\frac{p}{P} = \sqrt{\frac{a}{A}}$$

in which p and P are the settlements resulting from the application of a constant unit load to areas a and A, respectively.

These experiments were carried out upon artificially prepared soils composed of measured proportions of clay and sand, tamped into a specially built bin. Loading blocks were used varying in area from 1 sq.in. to 9 sq.ft.

The experimenters expressed the belief that, so long as the penetrations are small enough to permit the soil to act for the most part elastically, the above relationship will hold true for any size bearing areas, and suggested that it may be applied to the design of footings for bridges and other structures.

Their test reports show no penetrations greater than 0.1 in. It may be inferred that that figure approximates the limit of elastic deformation of the artificially mixed soils. The elasticity of natural soils may differ greatly from that of artificially prepared soils; hence one would expect to be able to apply the theory to greater settlements than 0.1 in. This certainly would be necessary if it is to be of practical usefulness.

A load of 3,700 lb. per sq.ft. on the yellow-clay test curve shows an indicated penetration of approximately 0.1 in. The piers in the outer ring of the tank foundation built upon the yellow clay have an area of almost 85 sq.ft. Calculated settlement would then be:

$$\frac{0.1}{P} = \sqrt{\frac{0.4}{85}}$$

$$P = 1.45 \text{ in.}$$

Whereas, the average measured settlement was approximately 0.1 in.

Applied to the softer blue clay supporting larger foundations the disagreement between theory and measured results is still more pronounced. The predicted settlement from the formula is $5\frac{1}{2}$ in. against an average measured settlement of $\frac{3}{8}$ in.

Obviously the area relationship proposed by the Bureau of Public Roads is inapplicable to the soil conditions and foundation sizes herein described.

An expression for obtaining the load W that can be safely applied to a soil is proposed by C. C. Williams,[4] which seems to the writer to be more rational than any yet suggested. However, its usefulness is greatly limited because of the difficulty of fixing satisfactory values for some of its terms. The expression is:

$$W = Ap + Lf$$

in which A is the bearing area, p the supporting capacity in compression per unit area for a given deformation, L the length of the perimeter, and f the supporting capacity in shear per unit length around the perimeter.

From the formula it is manifest that when the shearing strength is nil, the supporting power varies directly as the area. Any shearing capacity causes the supporting power per unit of area to decrease as the area increases. It is the writer's opinion that the Columbus yellow clay has a greater shear modulus than the softer blue clay. By considerable effort the blue clay could be spaded, but spading was impossible in the harder and tougher yellow clay. In spite of this, the supporting capacity of the yellow clay seemed to vary directly as the area; whereas the softer material showed a slight tendency to decrease in supporting strength with an enlargement of bearing area.

If the direct compressive strength of the yellow clay greatly exceeds that of the blue clay, which it probably does, its larger shearing strength may be a smaller proportion of its supporting capacity than is the smaller shearing strength of the blue clay in respect to its supporting capacity. Such an assumption renders the above situation entirely rational. It does, however, direct attention to both the importance and the difficulty of determining, from ordinary tests, the true shear and compressive moduli.

A few isolated tests demonstrate little, but it would appear that the engineer will have to continue, for some time at least, to rely largely upon his own judgment in interpreting and applying information derived from small-scale tests.

* * *

[1] "A Treatise on Masonry Construction," by I. O. Baker. (John Wiley & Sons).

[2] "Foundations for Bridges and Buildings," by H. S. Jacoby and R. P. Davis. (McGraw-Hill Book Co.)

[3] "The Supporting Value of Soil as Influenced by the Bearing Area," by A. T. Goldbeck and M. J. Bussard. (*Public Roads*, January, 1925.)

[4] "The Design of Masonry Structures and Foundations," by C. C. Williams. (McGraw-Hill Book Co.

Treatment of Water Supply After Long Beach Earthquake

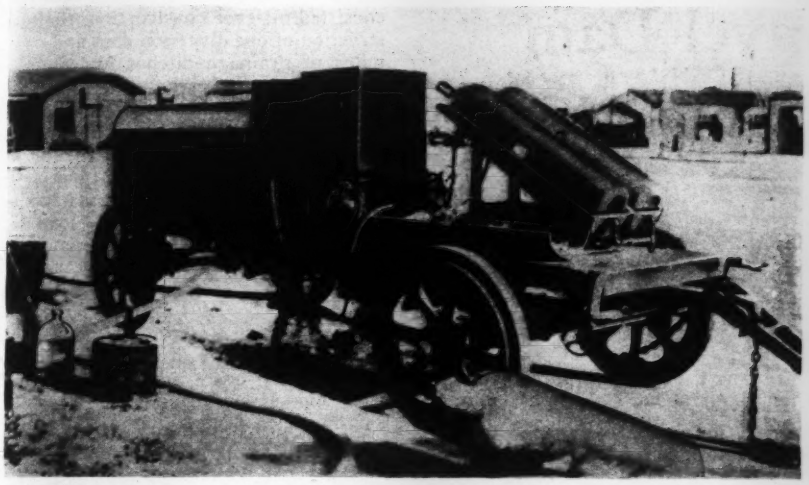
By R. F. Goudey
Sanitary Engineer, Dept. of Water and Power, Los Angeles, Calif.

A TRAILER-MOUNTED chlorinating unit containing pumps driven either by electricity or gasoline engine for the purpose of injecting chlorine into water mains under pressure was used effectively during the emergency treatment of the Long Beach water supply following the earthquake on March 10, 1933. This portable chlorinating unit had been developed three years previously by the Department of Water and Power, city of Los Angeles, for various emergency uses. Its principal advantages are: (1) ability to treat water in a distribution system under pressures up to 450 lb. per sq.in. without any interruption of service; (2) wide range of rate of chlorine feed, with a change in meters, from a few pounds to 750 lb. per day; (3) either electricity or gasoline engine can be used to operate the injector pump as required by conditions. A set-up is made by parking the chlorinator-trailer at the curb, stringing fire hose from one fire hydrant to the suction side of the injector pump and then laying a hose from the discharge side of the pump to another fire hydrant.

This chlorinator was immediately put into service at Wilmington the morning following the earthquake in order to treat several submarine crossings that had been reported as having failed. The chlorinator was also used to sterilize a few broken mains in that area. The Wilmington area is that portion of Los Angeles in the harbor district adjacent to Long Beach.

Immediately following the earthquake, Long Beach health officials ordered the boiling of the municipal water for drinking purposes, without having first obtained knowledge as to the exact condition of the water system. The notice was made particularly alarming and was broadcast every fifteen minutes over the radio for two days. Little wonder, therefore, that all public confidence in the water supply was completely destroyed. The shutting off of gas services only added confusion to the original order to boil water.

Dr. Charles W. Decker, city health officer, Los Angeles, who was appointed medical director of the devastated area, called the writer into consultation on the water-supply situation at Long Beach. Fred S. Porter, water superintendent, was immediately consulted, and the writer was given authority as sani-



Portable chlorinating unit mounted on trailer, used to disinfect water mains under pressure.

tary engineer of the Long Beach water department, without compensation, during the emergency.

The municipal water system of Long Beach comes from three groups of wells pumped directly into the water mains or storage tanks, depending upon the demands of the system. The population supplied is about 150,000. The size of mains varies from 4 to 30 in. in diameter. Normal water pressure is 80 lb. A survey of conditions immediately after the earthquake showed—first, that a small area in the southeast portion of the city had been isolated because of numerous breaks; second, that neither the sources nor the storage facilities had failed, so that the average pressure over the main portion of the city did not drop below 60 lb. per sq.in., although one gage near a large hydrant in the southwest district showed a minimum pressure of 20 lb. for a short period; third, there was no reason to suspect any pollution of the water at its source or in distribution. In order, however, to restore public confidence, it was thought desirable to treat the entire system so that residual chlorine could be found in the water at any part of the city. All water was brought to one point for chlorination, at the outlet of the steel tank reservoirs on Reservoir Hill. Having just completed the disinfection of the Wilmington supply, the portable chlorinator was hauled over to Long Beach, and the installation was completed in a few minutes. In fact, chlorine was applied to the entire water supply entering service just 30 hours after the first earthquake had occurred and nearly 24 hours before state officials arrived on the scene to take over general supervision from Dr. G. E. McDonald, city health officer.

The water was treated with a dose of 10½ lb. per million gallons. The residual chlorine was found in quantities of 0.3 to 2.0 p.p.m. in all of the south and east portions of the city within 24 hours after chlorination had been started. By this time an emergency chlorinator was set up to replace the portable chlorinator, which was then moved to the edge of the business district and used to pump chlorine into that part of the system which, on a previous day, had not shown residual chlorine reaching the taps. Over 70 samples of water were collected from all parts of the distribution system for bacteriological analyses, and every sample showed entire absence of B. Coli in 50-c.c. portions. A bulletin was then issued on the morning of March 13, stating that the water in service was safe for drinking purposes.

The small area in the southeast section of Long Beach known as Naples and Belmont Shore, which had been cut off, was then disinfected by the portable chlorinator for a two weeks' period while repairs were being made. At one time chlorine was fed into one section of this distribution system, and free chlorine was picked up at the furthermost point, nearly 2 miles away. Permanent chlorinating equipment has since been installed at two points on the Long Beach system before it enters the storage reservoirs, and a portable chlorinator similar to the one used in the emergency work has now been built by the city.

The portable chlorinator of the city of Los Angeles is unique and was designed expressly for emergency service. It consists of the following equipment: one vacuum-type chlorinator with full range of orifices, 10-hp. gasoline engine, 30-gal.-per-min. pump, 220/440-volt motor, scales for chlorine cylinders, cooling facilities for chlorine tanks under high rates of chlorine withdrawal, a full line of hydrant pipe fittings, gages for water and gas pressures and gallons per minute pumped, and a series of hoods that are placed around the whole trailer while it is being hauled from place to place. The construction of this unit was recommended by Dr. Carl Wilson, former director of sanitation, department of water and power, and the equipment and mechanical features were designed by S. M. Dunn, assistant mechanical engineer of the same department.

English Working-Class Houses Seen as Public Utilities

IN ADDITION to slum houses and tenements that must be razed to effect a housing reform—under the operation of the Housing Act of 1930—England has many working-class habitations that should and could be reconditioned, and so made into desirable dwellings. A report, recently issued, by the Departmental Committee on Housing, deals with this subject and recommends the granting of compulsory powers to local authorities to effect such changes through public-utility societies, who will repair, improve and manage the estates; or that the local authorities lease the houses, after acquisition, to house-management commissions, responsible to the authorities; or that the local authorities should be empowered to hold, repair and manage such houses themselves. Formation of a Central Public Utility Council is also suggested, which would recommend societies for the approval of the Minister of Health. Safeguards for owners and lessees are outlined, and provision is made for rehousing accommodation facilities.

A central financing authority, to obtain the necessary funds from the National Debt Commissioners, is to be empowered to advance to approved societies the money necessary to acquire and reconstruct properties and to provide rehousing accommodation. Recommendations are made that private enterprise and local authorities provide a larger proportion of small dwellings for the small-family group, estimated to constitute neary 70 per cent of all families in many of the large towns. Local authorities and public-utility societies should also be encouraged to provide without subsidy lodging houses with single rooms for unmarried men and women.

The committee proposes that the dispossessed owners should be paid what they themselves paid for the property, or the value accepted for death duties if they inherited it, or the value adopted for stamp duty if they acquired it by deed of gift. The idea of "giving them back their money" is suggested as an alternative to the expense, delay and uncertainty of arbitration.

The report recommends that, wherever possible, women should be employed as housing estate managers under the new plan.

Metal-Faced Gravel Dam Being Built in New Mexico

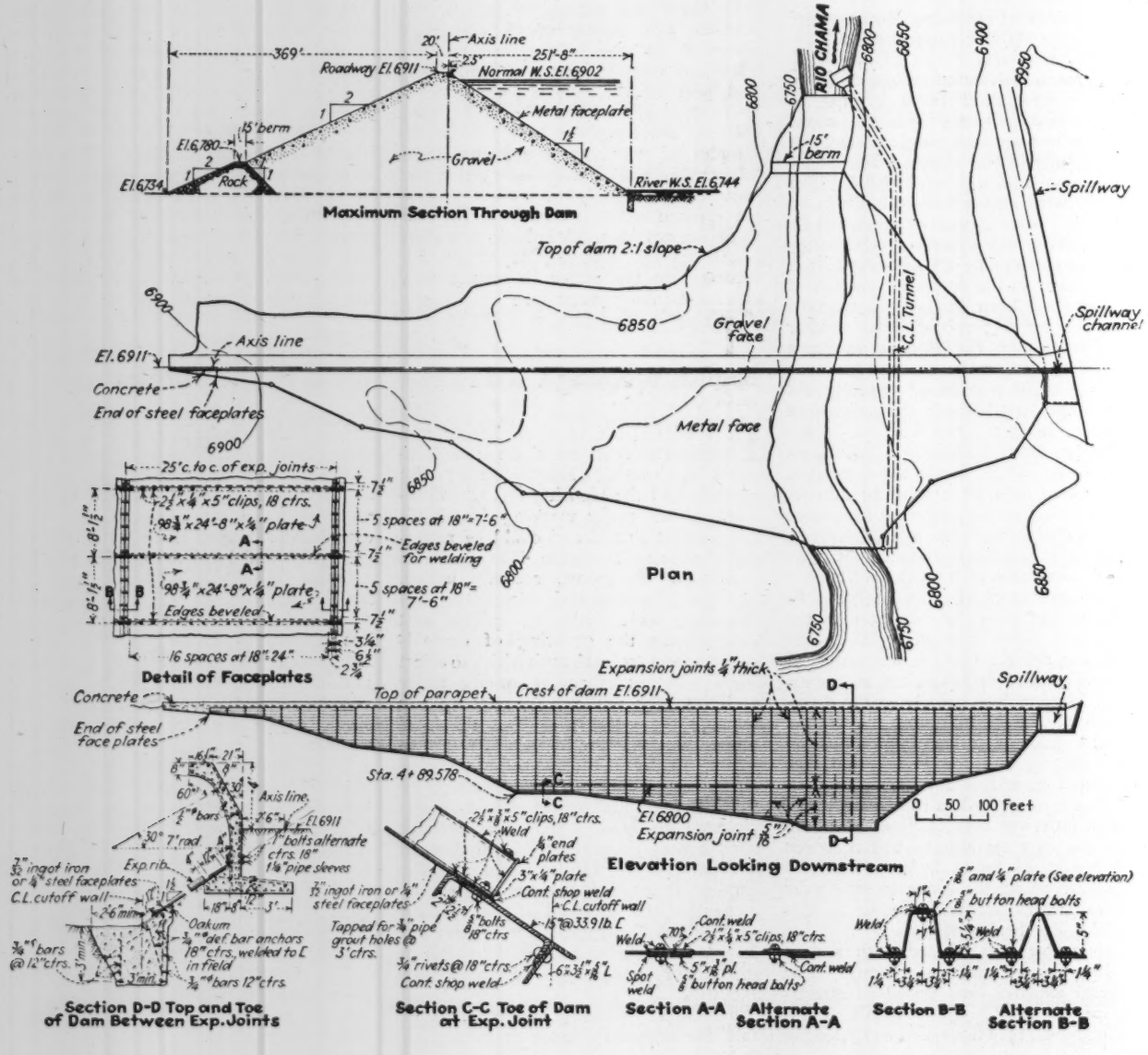
By H. P. Bunger
Designer,
Middle Rio Grande Conservancy District,
Albuquerque, N. M.

A METAL-FACED, gravel-fill dam is now under construction by the Middle Rio Grande Conservancy District in New Mexico to form a large storage reservoir as one element of the district's conservation program. Flood control, irrigation and drainage are included in this program for the development of a tract of 123,000 acres in central New Mexico lying along both sides of the Rio Grande and extending from White Rock Canyon down to 15 miles below Socorro, near the upper end of the Elephant Butte Reservoir, a distance of about 150 miles. The district's program, essentially, is one of conservation and restoration rather than of land development. Consequently, a large part of its work, since its organization about eight years ago, has consisted of levee construction, the construction of one diversion dam and many miles of drainage ditches and interior drains.

Present and future work includes other diversion dams, new main irrigation canals and the construction of the El Vado storage reservoir. In October of last year the Reconstruction Finance Corporation agreed to loan $5,784,000 to the district for this new construction work. (The district and its program were described in detail in *ENR*, June 12, 1930, p. 963.)

The El Vado Reservoir is being built in the upper part of the Rio Chama River valley near the New Mexico-Colorado state line, about 30 miles southwest of Chama, N. M., and 175 miles north of Albuquerque, N. M. The stored water that is to be released from the dam will flow down the Chama

Plan, section and elevation of the El Vado Dam with details of the metal-plate facing to be used to make the dam watertight.



River a distance of about 75 miles and then into the Rio Grande, from which it is diverted into the district's canals by means of four diversion dams and two headings. The Chama River has a drainage area of 650 square miles above the site and an estimated runoff of 400,000 acre-ft. The capacity of the reservoir will be 198,000 acre-ft.

The site of the dam is at the beginning of a box canyon where the river has cut through beds of shale and sandstone. In the right abutment the shale and sandstone layers are in place and will present little difficulty from a construction standpoint. On the left abutment the shale layers seem to have been leached out, and the sandstone has settled or slipped and is badly shattered or broken for a depth varying from 15 to 30 ft.

The dam when completed will be gravel fill with 1½ to 1 upstream slope and 2 to 1 downstream slope, with a crest length of 1,200 ft. and a maximum height of 170 ft. above streambed. The dam will contain about 515,000 cu.yd. of gravel. It is proposed in constructing the dam to place this gravel in 8-in. layers and then settle it by means of a liberal use of water and rolling. A general plan and section of the dam are shown in the accompanying drawing.

A vertical cutoff at the upstream toe of the dam will extend about 5 ft. into bedrock or into suitable impervious material and will vary in depth from 10 to 30 ft. In the river channel the bedrock is exposed. The cutoff wall will have a uniform thickness of 36 in. from bottom to top and will be reinforced with 1-in. round bars at 12-in. centers, placed both ways and at both faces. Grout holes varying in depth from 20 to 30 ft. will be drilled at 5-ft. centers along the entire length of the cutoff.

The gravel fill is to be protected from percolation and wave action by a watertight welded diaphragm of steel or ingot-iron plates (either corrugated or flat), placed directly upon the upstream slope of the fill. The plates will be ¼-in. steel or No. 5 gage ingot iron, in sizes varying in width from 52 to 100 in. and in lengths from 18 to 30 ft. A combined contract for furnishing and placing the steel will be let in the near future. The details as proposed by the district also are shown in the accompanying drawing.

The right of companies interested in the work to furnish their own details has been allowed in the specifications. These details will have to be approved by the district's engineers.

The plates will be welded to a base or apron channel, which will be securely attached or anchored into the cutoff. At the crest the face plate will be free to move. Details of base and parapet connections are shown.

The total weight of metal is estimated to be between 1,150 and 1,200 tons. Approximately 60,000 lin.ft. of welding will be required for the main seams.

Diversion of the river during construction will be through a 12-ft. diameter, horse-shoe-shaped tunnel lined with a minimum of 9 in. of concrete throughout.

When the dam is completed to a point where floods can be stored and discharged through the spillway, the tunnel will be bulkheaded off and the outlet works will be placed within the tunnel.

Stored water will be released as needed through a 78-in. diameter penstock, 630 ft. long, controlled at the upper end by a 78-in. diameter butterfly valve, hydraulically operated. At the lower end it will branch into two 60-in. pipes for connection to two 54-in. needle valves. Estimated weight of metal in penstock and valves is 350,000 lb.

The operating spillway is figured to discharge 16,500 sec.-ft. with water at 5 ft. above normal and 20,000 sec.-ft. with water at the crest of the dam.

The spillway chute is 1 000 ft. long with a base 36 ft. wide at the intake end and 20 ft. wide at the outlet end, where it discharges over a cliff 60 ft. high into the riverbed. The point of discharge is 500 or 600 ft. downstream from the toe of the dam. This chute will be lined throughout with reinforced concrete or steel plate depending on comparative costs. Discharge into it will be regulated by an automatic radial gate 36 ft. wide by 22 ft. 6 in. high.

A freeboard of 9 ft. is allowed between normal water surface and the crest of the dam, and 13 ft. is allowed between the normal water surface and the top of the parapet.

The dam is being constructed by force account under the supervision of the Board of Commissioners of the Middle Rio Grande Conservancy District, and under the direction of C. H. Howell, chief engineer of the district, with H. V. R. Thorne, construction superintendent, and Chas. P. Seger, construction engineer.

Wide Range of Road Work in Emergency Program

Analysis of highway projects approved by PWA, giving types, mileages and progress in getting work under contract as of Oct. 1, 1933

TYPES and volumes of highway improvements to be carried on with the $400,000,000 of PWA funds granted to states are summarized as of Oct. 1, 1933, in the following tables and statistical statements. These figures are as reported by the four district vice-presidents (twelve states each) of the American Association of State Highway Officials at the annual convention of the organization in Milwaukee, Oct. 9 and 10. As the first summary made public, which gives to highway contractors and manufacturers of road materials a quantitative basis for estimating the amounts of business activity made available by the emergency program, the figures are particularly important. It will be understood that where the figures relate to contracts awarded they are true only for the date named, as more projects are being put under contract daily. The statements by districts follow:

* * * *

First District

By H. E. Sargent
Commissioner of Highways, Vermont

THE total allotment for the district is $76,633,870. The PWA highway work of most states is so interwoven with programs of their own that it is impossible to make a definite separation. In many states, due to new problems created by the PWA requirements, the programs are not at this date complete.

Maine—Allotment of $3,369,917, divided 50, 25 and 25 per cent between state, municipal and secondary projects. The state road program includes 34 highway projects involving the construction of approximately 2.7 miles of concrete, 33.58 miles of bituminous macadam, 19.54 miles of gravel and 14.33 miles of widening with bituminous macadam; also eight bridge projects. The municipal program includes twenty road projects and two bridge projects; the road projects provide for approximately 8.22 miles of concrete, 7.99 miles of bituminous macadam and 1.57 miles of bituminous shoulder widening. The secondary-road program involves 102 highway projects and five bridge projects (97.9 miles of gravel surface) built on a day-labor basis.

New Hampshire—The state allotment is $1,909,839 and is divided according to the percentages specified in the rules and regulations. On the federal-aid program there are twelve projects that call for about 9.5 miles of concrete road, 3.5 miles of bituminous macadam and 4 miles of gravel with mixed-in-place sur-

TABLE I—PROGRESS OF PWA ROAD CONSTRUCTION IN TWELVE SOUTHERN STATES

State	PWA Allotment	Reg. Fed. Aid Balance	Total Fed. Fds. Available	Life of Program, Months	Contr's Awarded Amount	Contr's Awarded No.	Proj's Advt. Amount	Proj's Advt. No.	Plans and Estimates, Amount	Sub-mitte No.
Florida	$5,231,834	$989,000	$6,220,934	12	$1,256,741	12	$405,179	5	$671,149	8
North Carolina	9,522,293	977,000	10,499,293	15-18	1,200,000	30	.....	0	1,200,000	12
Kentucky	7,517,359	48,000	7,565,359	18	950,000	11	1,100,000	20	2,300,000	45
Tennessee	8,492,619	576,000	9,068,619	...	641,000	7	900,000	14	1,000,000	
Virginia	7,416,757	194,000	7,610,757	...	1,153,600	28	349,000	7	2,219,000	51
South Carolina	5,459,165	12,000	5,471,165	18	577,000	13	975,000	14	231,000	6
Georgia	10,091,185	100,000	10,191,185	14	.....	0	.....	0	2,000,000	
Alabama	8,370,133	3,100,000	11,470,133	12	1,000,000	5	1,000,000	8	7,000,000	
Mississippi	6,978,675	2,952,000	9,930,675	...	330,000	3	880,000	3	.....	
Louisiana	5,828,591	.....	5,828,591	15	810,000	8	233,000	2	1,000,000	9
Arkansas	6,747,335	663,000	7,410,335	16	330,000	4	234,000	1	.....	0
Oklahoma	9,216,798	433,000	9,649,798	...	1,836,879	14	106,344	2	1,387,991	9
Total	$90,872,744	$10,044,000	$100,916,744	...	$10,085,220	135	$6,182,523	76	$19,009,140	143

PER CENT OF TOTAL FEDERAL FUNDS AVAILABLE

	Fla.	N. C.	Ky.	Tenn.	Va.	S. C.	Ga.	Ala.	Miss.	La.	Ark.	Okla.	Aver
Contracts awarded	20	11	12	7	16	10	0	9	3	14	4	19	10
Projects advertised	7	0	15	10	5	18	0	9	9	4	3	1	6
Plans and estimates submitted	11	11	30	11	32	4	19	61	0	18	0	14	19
Total	38	22	57	28	53	32	19	79	12	36	7	34	35

face; also two overpass bridges over railroads and three river bridges, these five structures costing about $175,000. There are eleven municipal projects that will call for 5.5 miles of concrete and 4.5 miles of bituminous macadam. The secondary system also has eleven projects, which will call for 25 miles of gravel, part of which will be surface-treated and part will have mixed-in-place surface. There are also four bridges.

Vermont—The state allotment is $1,867,573. It is scheduled to construct 49 projects, which will close eleven gaps in the federal-aid and state-aid system and will increase the surfaced mileages as follows: concrete, 16 miles; macadam, 10 miles; mixed-in-place, 87 miles; gravel, 9 miles; and three bridges. On one 7.5-mile project, the right-of-way of the Woodstock Railroad has been taken over and used for the new highway location.

Massachusetts—The state allotment is $6,597,100. Massachusetts has a program of 74 miles of road and 26 bridges and has requested under the 30/70 provision additional funds for 74 miles of road and eight bridges.

Connecticut—The state allotment is $2,865,740. The proposed program includes eighteen projects totaling 64 miles of bituminous macadam, concrete and sheet asphalt; and in addition, 9.5 miles of landscaping work. One road-construction project, 11 miles of macadam, is estimated at $440,000.

Rhode Island—The state allotment is $1,998,708. The program contemplates the improvement of eight streets as extensions of the federal highway system in seven cities of the state, $580,000; eleven projects on the federal-aid highway system outside of cities, $1,000,000; and thirteen projects on secondary or feeder roads, $408,000.

New York—The state allotment is $22,330,101. No summary is given.

New Jersey—The state allotment is $6,346,039. The money is scheduled to improve 60 miles in 25 projects and includes 15 bridges and overpasses. One project, 13.4 miles long, includes bridge construction and costs $1,400,000; another, 11.6 miles long, costs $1,475,000 including bridge work.

Delaware—The state allotment is $1,814,088. The work planned includes the completion of the dual highway to Dover and the dual highway to the Maryland line near Elkton; also the widening of a considerable mileage of main highways constructed twelve or fifteen years ago less than 20 ft. in width. The state is also planning a by-pass around Wilmington. This project will be particularly desirable to very heavy truck traffic, which amounts to 2,000 trucks per day, and will be on a low grade avoiding two long 6 per cent grades on the present route.

Pennsylvania—The state allotment is

TABLE II—PWA FUNDS ALLOTTED IN TWELVE CENTRAL STATES AND THEIR DISTRIBUTION BETWEEN H, M AND S PROJECTS

State	Total Amount	H Projects P.C.	H Projects Amount	M Projects P.C.	M Projects Amount	S Projects P.C.	S Projects Amount
Illinois	$17,570,770	25.22	$4,431,348	39.14	$6,877,200	35.64	$5,262,222
Ohio	15,484,592	45.0	6,968,066	30.0	4,645,378	25.0	3,871,148
Michigan	12,736,227	40.0	5,094,491	35.0	4,457,679	25.0	3,184,057
Missouri	12,180,306	50.0	6,090,153	25.0	3,045,077	25.0	3,045,077
Indiana	10,037,843	47.0	4,717,786	48.0	4,818,165	5.0	501,892
Wisconsin	9,724,881	50.0	4,862,441	26.0	2,431,220	25.0	2,431,220
Minnesota	10,656,569	48.0	5,115,153	32.0	3,410,102	20.0	2,131,314
Iowa	10,055,660	50.0	5,237,000	25.0	2,525,000	25.0	2,578,000
Kansas	10,089,604	50.0	5,044,802	25.0	2,522,401	25.0	2,522,401
Nebraska	7,828,961	50.0	3,914,481	25.0	1,957,240	25.0	1,957,240
South Dakota	6,011,479	50.0	3,005,739	25.0	1,502,870	25.0	1,502,870
North Dakota	5,804,448	50.0	2,902,224	25.0	1,451,112	25.0	1,451,112
Total	$128,181,340	44.0	$57,383,684	31.0	$39,643,444	25.0	$31,638,553

TABLE III—PWA WORK UNDER CONTRACT IN TWELVE CENTRAL STATES, OCT. 1, 1933

State	Total Amount	H Projects Amount	M Projects Amount	S Projects Amount	Estimated Cost Index*
Illinois	$1,005,047	$336,782	$330,105	$338,160	123
Ohio	5,857,442	4,727,430	1,130,012	none	140
Michigan	1,224,000	1,200,000	24,000	none	115-2
Missouri	2,732,073	2,557,464	174,609	none	125
Indiana	1,750,000	1,750,000	.....	.....	.....
Wisconsin	2,143,000	1,492,000	437,000	214,000	100
Minnesota	2,199,000	1,421,000	663,000	115,000	110
Iowa	3,309,000	2,486,000	347,200	476,400	120
Kansas	1,769,000	1,500,000	203,000	66,000	125
Nebraska	3,300,000	2,700,000	200,000	400,000	.....
South Dakota	1,800,000	1,500,000	150,000	150,000	115-2
North Dakota	750,000	750,000	.....	.....	125
Total	$27,839,162	$22,420,676	$3,658,926	$1,759,560	
Per Cent	22% of total allotment	40% of total H allotments	9% of total M allotments	6% of total S allotments	

*Cost index = PWA contract price/1932 price.

TABLE IV—PROPOSED H CONSTRUCTION BY TYPES IN TWELVE CENTRAL STATES
(MILES OF TWO-LANE CONSTRUCTION OR EQUIVALENT)

State	Concrete Pavement or Equivalent Miles	Concrete Pavement or Equivalent Amount	High-Type Bituminous Miles	High-Type Bituminous Amount	Medium-Type Bituminous Miles	Medium-Type Bituminous Amount	Low-Type Bituminous Miles	Low-Type Bituminous Amount	Untreated Grav. or Equiv. Miles	Untreated Grav. or Equiv. Amount	Grading Only Miles	Grading Only Amount
Illinois	44.3	$1,640,400	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Ohio	100.0	4,277,458	40.0	$875,900	15.0	$229,888	.....	.....	20.0	$388,142	.....	.....
Michigan	106.6	2,558,000	....	.....	10.3	135,000	33.3	$173,000	136.5	810,000	89.7	$660,000
Missouri	127.0	3,765,000	....	.....	.....	.....	16.0	40,000	8.5	19,000	24.7	352,000
Indiana	159.8	3,785,800	....	.....	.....	.....	.....	.....	29.0	215,000	6.4	125,000
Wisconsin	112.5	3,023,000	....	.....	37.6	360,000	108.3	531,000	13.0	255,000	25.6	165,080
												(Misc. 3,000)
Minnesota	23.0	574,000	....	.....	.....	.....	777.0	2,610,000	None shown		146.0	926,000
Iowa	136.5	3,047,000	....	.....	.....	.....	135.8	351,000	32.8	48,000	153.2	1,311,000
Kansas	83.0	1,573,200	....	.....	(None at this time)		124.0	221,320	82.9	104,230	455.6	3,055,000
Nebraska					None shown							
So. Dakota	25.0	600,000	....	.....	.....	.....	.....	.....	174.0	350,000	120.0	500,000
No. Dakota	.....	.....	.....	.....	.....	.....	100.0	470,000	542.0	650,000	600.0	1,800,000
Total	917.7	$24,843,058	40	$875,900	62.9	$724,888	1,294.4	$4,396,320	1,038.7	$2,839,372	1,621.2	$8,897,080
Average per Mile		$27,200		$21,900		$11,500		$3,400		$2,800		5,500
Per Cent of Grand Total, ($57,289,123)		43		1.5		1.3		8		5		15

GRAND TOTAL—4,975 miles

TABLE V—PROPOSED S CONSTRUCTION BY TYPES IN TWELVE CENTRAL STATES
(MILES OF TWO-LANE CONSTRUCTION OR EQUIVALENT)

State	Concrete Pavement or Equivalent Miles	Concrete Pavement or Equivalent Amount	High-Type Bituminous Miles	High-Type Bituminous Amount	Medium-Type Bituminous Miles	Medium-Type Bituminous Amount	Low-Type Bituminous Miles	Low-Type Bituminous Amount	Untreated Grav. or Equiv. Miles	Untreated Grav. or Equiv. Amount	Grading Only Miles	Grading Only Amount
Illinois	30.4	$784,320	.....	.....	6.3	$58,700	31.45	$203,000	254.25	$1,381,500	.....	.....
Ohio	30.0	985,901	30.1	$671,616	20.0	315,847	.....	.....	35.00	562,748	.....	.....
Michigan	28.4	794,000	1.0	30,000	15.2	128,000	98.4	702,000	93.40	397,000	512.0	$414,000
Missouri	3.4	110,000	....	.....	.....	.....	.....	.....	88.00	220,000	316.0	1,250,000
Indiana					In preparation							
Wisconsin	49.1	1,215,500	....	.....	....	.....	142.7	675,000	62.6	675,000	.....	.....
Minnesota	9.0	240,000	....	.....	....	.....	95.0	185,000	.....	.....	150.0	1,073,000
Iowa	13.6	350,000	.....	.....	.....	.....	46.8	119,500	24.4	49,000	246.6	1,942,500
Kansas	7.24	175,000	(None at this time)				.....	.....	40.45	59,050	311.9	1,807,015
Nebraska					None shown							
So. Dakota	.....	.....	....	.....	....	.....	.....	.....	4.00	30,000	50.0	120,000
No. Dakota	.....	.....	.....	.....	.....	.....	.....	.....	335.00	335,000	372.0	1,116,000
Total	171.1	$4,654,721	31.0	$701,616	41.5	$502,547	414.4	$1,884,500	937.10	$3,709,298	1,497.7	$7,722,515
Average Per Mile		$27,200		$22,600		$12,100		$4,550		$4,000		$7,750
Per Cent of Grand Total, ($31,638,553)		15		2		1.5		6		12		24

$18,891,004. Pennsylvania's allotment has been approved as follows: municipal program, 28.67 per cent; federal-aid system, 30.48 per cent; secondary program, 40.85 per cent. Bids are being received and work is progressing rapidly in the completion of plans, specifications and estimates.

West Virginia—The state allotment is $4,474,234. Bids were received on Aug. 29 and 30 and Sept. 19, representing approximately $1,300,000 of the program. The work includes 25 miles of concrete, 10 miles of surface treatment, 13 miles of grading and 13 bridges.

Maryland—While Maryland's allotment is $3,564,527, with the aid of other government money and its own funds, the state roads commission has set up a highway construction program of 32 projects costing $12,000,000. The first two items of the program are as follows:

1. Philadelphia road, 29.8 miles, Baltimore and Harford Counties. This appropriation is estimated to build a 56-ft. paved highway with a sidewalk on each side from the Baltimore city line to Golden Ring, and two 20-ft. paved highways separated by 6-ft. center parking and an 8-ft. gravel shoulder, and a sidewalk area on each roadway, to the Susquehanna River at Havre de Grace. Estimated cost $2,865,000.

Belair road, Baltimore and Harford Counties, a 40-ft. paved highway with a sidewalk on each side through the developed suburban area of Baltimore County and a 30-ft. highway with an 8-ft. dirt shoulder and sidewalk area on each side to Belair. Estimated cost $1,062,000.

Second District

By B. M. Duncan
State Highway Engineer, Florida

THE ALLOTMENTS of PWA funds and the progress of work in the twelve states of this district are shown in Table I. This program has made it possible for the highway departments to complete the long-delayed, expensive and troublesome gaps in the primary and secondary highway systems. For the first time federal funds are available to construct the main highways through the smaller towns and cities of proper width, type and refinement to relieve congested areas on the main highway system. The expenditure of these funds in municipalities will have a moral effect on our city governments that will, no doubt, be helpful during the coming sessions of the legislature, when the cities continue their demands for a part of the gasoline funds. These municipal projects will also give employment in the centers of population where relief is most needed.

Third District

By Thos. J. Pattison
Wisconsin Highway Department

THE DISTRIBUTION of the allotment to the H, M and S projects is shown in Table II. Taken as a whole, the distribution follows very closely the distribution suggested by the act, being

TABLE VI—CLASSIFICATION OF WORK ON STATE HIGHWAY PROJECTS IN TWELVE WESTERN STATES

State	Grading and Rock Surfacing Miles	Grading and Rock Surfacing Amount	Oiling and Paving Miles	Oiling and Paving Amount	Structures No.	Structures Amount
Montana	292.7	$2,903,000	86.5	$400,000	88	$900,000
Wyoming	225.0	636,663	383.0	1,500,000	3	114,000
Colorado	121.0	2,000,000	27.0	350,000	14	1,200,000
Texas	1,089.0	6,787,452	226.0	3,541,670	49	1,792,890
Idaho	98.7	1,075,000	138.7	896,000	22	272,125
Utah	27.0	322,000	151.4	1,389,101	11	253,714
New Mexico	99.6	1,082,000	504.5	2,919,505	4	256,000
Arizona	121.8	1,393,307	259.0	2,362,953	3	55,000
Nevada	184.7	1,257,000	198.3	903,000	2	48,000
Washington	72.7	1,519,433	37.9	1,265,500	7	273,000
Oregon	71.1	1,457,448	204.3	1,448,000	7	148,000
California	45.0	920,000	320.0	6,000,000	48	883,677
Totals—Highways	2,448	$21,353,303	2,537	$22,975,729	258	$6,196,396
Secondary	2,160	12,680,395	351	4,880,597	157	2,113,732
Municipal	127	1,671,120	277	13,671,797	71	5,049,953
Grand Total	4,735	$35,704,818	3,165	$41,528,123	486	$13,359,081

TABLE VII—RAILROAD GRADE-SEPARATION STRUCTURES IN TWELVE CENTRAL STATES

State	Total No.	Total Cost	Railroad Grade-Separations: H Projects No.	H Projects Cost	M Projects No.	M Projects Cost	S Projects No.	S Projects Cost
Illinois	73	$5,060,500	32	$2,152,500	28	$2,071,000	13	$837,000
Ohio	8	1,079,000	4	409,000	4	370,000	2	300,000
Michigan	4	98,000	2	40,000	2	58,000	..	.....
Missouri	26	843,000	14	368,000	10	435,000	2	40,000
Indiana	11	565,000	11	565,000	..	.....	..	.....
Wisconsin	4	390,000	2	200,000	1	100,000	1	90,000
Minnesota	26	538,000	16	283,000	9	230,000	1	25,000
Iowa	32	1,076,000	16	394,000	14	640,000	2	42,000
Kansas	8	235,000	4	100,000	3	100,000	1	35,000
Nebraska			None shown					
South Dakota			None shown					
North Dakota	5	141,000	3	68,000	2	73,000		None
Total	197	$10,025,500	104	$4,579,500	73	$4,077,000	22	$1,369,000

44, 31, and 25 per cent. The lowest allotment to H projects is in Illinois, which has for years carried out an extensive paving program on its primary highways. The next lowest is Michigan, which also has been building heavily on its main lines for years. Six of the twelve states placed the maximum possible on H projects. The same six allocated the minimum permitted by the statute to M projects. Not less than nine out of the twelve allocated the maximum of 25 per cent permitted by the statutes to secondary roads. The advanced state of improvement on primary roads in Illinois is shown by their allocation of 35 per cent to secondary highways, for which special permission was necessary. The only state which made a low allocation to secondary roads was Indiana, with 5 per cent.

The estimated condition with respect to the letting of contracts as of Oct. 1 is shown in Table III. It appears that contracts have been let for approximately 22 per cent of the total program and that about 80 per cent of the total lettings have been on H projects, of which 40 per cent of the total has been contracted. Contracts on M projects represent only 9 per cent of the total amount set aside, and the same figure for S projects is only 6 per cent of the total. These figures indicate quite clearly that the state highway departments as a whole have been concerned principally with the development of the main lines of travel in the rural dstricts, and that the letting of contracts and the subsequent prosecution of the work have lagged behind on municipal and secondary projects, pending the preparation of plans. Delay in securing approval of project statements is responsible for some of the delay in getting S projects under way. The character of improvements projected for class H projects is shown in Table IV. The outstanding fact is that concrete paving is by all odds the most popular type of improvement, with 90 per cent of the grand total amount reported on. Next in popularity is the low-cost bituminous pavement. The average cost per mile of this indicates that there is very little, if any, grading in connection with it. Only one state (Ohio) proposes to use a high-type bituminous pavement, costing $18,000 per mile or more. The medium-cost bituminous pavement is not much more popular, with a total of 62.9 miles in three states. The showing for grading and graveling projects is quite respectable. It is of interest to note that a substantial portion of the program for H improvements contemplates grading alone.

TABLE VIII — CLASSIFICATION OF WORK ON MUNICIPAL HIGHWAY PROGRAM IN TWELVE WESTERN STATES

State	Grading and Rock Surfacing: Miles	Grading and Rock Surfacing: Amount	Oiling and Paving: Miles	Oiling and Paving: Amount	Structures: No.	Structures: Amount
Montana	.....	.....	38.9	740,000	7	$74,000
Wyoming	.....	.....	17.0	1,125,332	...	.....
Colorado	.....	.....	36.0	1,310,000	6	335,000
Texas	104.0	$1,021,620	61.0	2,326,272	33	2,713,114
Idaho	7.8	198,500	11.0	270,700	8	608,000
Utah	0.8	8,000	15.6	524,835	4	70,000
New Mexico	*	28,000	*	358,000	*	495,000
Arizona	.....	.....	22.3	700,000	2	100,000
Nevada	.....	.....	9.7	485,000	...	.....
Washington	5.3	207,000	32.8	1,682,934	6	83,000
Oregon	8.9	208,000	32.4	1,148,724	5	170,000
California	.....	.....	*	3,000,000	3	401,839
Totals	127	$1,671,120	277	$13,671,797	74	$5,049,953

*Not reported.

TABLE IX — CLASSIFICATION OF WORK ON SECONDARY-ROAD PROGRAM IN TWELVE WESTERN STATES

State	Grading and Rock Surfacing: Miles	Grading and Rock Surfacing: Amount	Oiling and Paving: Miles	Oiling and Paving: Amount	Structures: No.	Structures: Amount
Montana	320.6	$1,400,000	28.9	$173,000	51	$150,000
Wyoming	191.0	1,125,332	.....	.....	...	.....
Colorado	265.0	1,390,000	10.0	275,000	3	58,000
Texas	886.0	5,348,813	75.0	117,505	21	594,688
Idaho	142.6	790,000	74.3	364,000	1	11,924
Utah	52.8	379,000	60.4	339,000	2	40,000
New Mexico*	.....	.....	.....	.....	...	.....
Arizona	18.0	140,700	41.3	375,000	2	85,000
Nevada	110.1	786,000	15.0	45,000	3	66,000
Washington	65.9	992,000	4.4	83,000	1	10,000
Oregon	108.0	584,350	41.4	456,254	47	486,120
California	†	637,000	†	2,652,838	26	612,000
Totals	2,160	$12,680,395	351	$4,880,597	157	$2,113,732

*Program not approved when submitting information for tabulation.
†Not reported.

The character of improvements set up on secondary roads is substantially the same as for the primary roads, as is shown by Table V. Here again the most popular type of improvement is concrete paving, and the next in popularity is low-cost bituminous. It is interesting to note that the estimated cost of concrete pavements proposed on S projects is the same as on H projects, and substantially the same is true with reference to high-type and medium-type bituminous. The cost of low-type bituminous work is more than $1,000 higher per mile, probably indicating that more strengthening of bases was necessary on the secondary roads. The same comment would apply to untreated gravel surfaces. The average cost of grading per mile is almost 50 per cent higher per mile than on the primary roads, indicating that more grading was necessary on the secondary roads, and possibly indicating that the original grading done on the primary roads is of some value after all.

The popularity of the low-cost bituminous highway is shown in Tables IV and V. A total of 1,709 miles will be built at a total cost of $6,280,820, an average cost of $3,680 per mile. The next in mileage is the concrete pavement with 1,089 miles, at a total cost of $29,497,779 and an average cost of $27,200. The amount needed to build 1 mile of concrete pavement represents the cost of 7½ miles of low-cost bituminous road. It appears that the states in the third district are using low-cost bituminous roads extensively, probably with a view to securing a large mileage of serviceable highways at a cost per mile they can afford to pay with the current reduced budgets.

The extent to which the PWA funds will be applied to the building of railroad grade-separation structures is shown in Table VII. The elimination work to be carried out under the program reaches the imposing total of 197 separations, nearly 17 per state. The leader in this work is Illinois, with a total of 73, estimated to cost more than $5,000,000. The states with the smallest numbers are Michigan and Wisconsin.

with four each. The difficulties encountered in carrying out separations under the PWA program are largely represented by the average cost of the various projects, which ranges from $135,000 per separation in Ohio and $70,000 in Illinois down to $28,000 in North Dakota. The average cost of the four to be carried out in Wisconsin is close to $100,000, indicating that all of the easy jobs have been finished and that those remaining to be done are the tough ones.

Fourth District

By R. H. Baldock
State Highway Engineer, Oregon

THE federal government has allotted to the eleven Western states, Texas and the Territory of Hawaii highway funds amounting to $97,000,000. The amounts allotted to the several states vary from $24,200,000 for Texas to $1,900,000 for Hawaii. These amounts are roughly three times the amounts heretofore annually allotted by the regular federal-aid appropriation.

This does not mean that the construction programs of the various states will be three times as great as under normal federal-aid appropriations, for the reason the comparatively little state money is available this year to be expended in cooperation with the federal money. The volume of work to be handled, however, will be greater than during normal times by at least 50 per cent and therefore will draw heavily on the available highway-construction facilities.

The work to be accomplished with the money comprises all of the usual classes of highway construction such as grading, surfacing, oiling, bituminous macadam, paving and bridge construction. It will include both new construction and reconstruction work. The tendency in the Western states seems, however, to favor those classes of work and those projects which will reduce rather than increase maintenance expense. Most states apparently have reached the point where maintenance costs are becoming burdensome, and there is a manifest desire to replace types of construction involving high maintenance costs with types having low maintenance cost. There is also a tendency to reconstruct existing highways in preference to adding more miles of new highways. Tables VI, VIII and IX show the classification of work by states.

Letters to the Editor

Correction—"Worst Water"

Sir—In connection with my article published in your issue of Sept. 7, entitled "The Worst Water in the West Made Fit to Drink" (p. 279, first column), the first sentence reads as follows: "By this method of sludge recirculation there is indicated a saving of 96 per cent, or 139 lb., of hydrated lime, and 97 per cent, or 390 lb., of soda ash per m.g. of water treated."

This should have been written: "By this method of sludge recirculation there is an indicated saving in 96 per cent hydrated lime of 139 lb., and in 97 per cent soda ash of 390 lb. per m.g. of water treated."

D. M. Forester.

Boulder City, Nev.,
Sept. 15, 1933.

Flow of Water Around Bends

Sir—You have recently published some articles on the flow of streams around bends; but none has presented a mathematical reason for the transverse movements therein. The following discussion therefore may be pertinent.

At any point in any stream flowing around any bend at any circumferential velocity, the relative velocity at the free surface and at any other point along a vertical line extending to the bottom may be represented fairly by a plain parabola or some other nearly equivalent curve.

The free surface may be level or sloping, up or down, on a straight or curved line in any direction, wave-like, or "choppy," without materially affecting what follows.

Assume a vertical reference line at a distance r from center of curvature of the bend at any point under consideration; let v denote the circumferential velocity at or near the free surface, and m the mass of any convenient unit of volume of water.

At some point along the reference line, either at or near the bottom, there will be a point where the circumferential velocity will be only one-quarter that at the top or near the free surface; denote the velocity at or near the bottom by v_1.

The weight of equal volumes of water, or water and solids in suspension, at the surface and bottom will probably not vary over 1 per cent; so our error will be small if m is considered constant.

In its simplest form the centrifugal force devloped by any unit of volume of matter moving in a curved path is expressed by the equation $f = m\,v^2/r$— in which f is the centrifugal force.

We then have, for any unit of volume:

At or near the free surface—

$$f = (m/r)v^2$$

Variations in the value m have little effect on the ratio. If the weight of the water at the bottom was in excess of that of solid lead, an unbalanced condition would still exist.

Nature has ordained that, in fluids, energy in the form of form of pressure or velocity is mutually convertible either wholly or in such parts as may be required to stabilize conditions.

In a "free-surface" stream the excess pressure is in part relieved by transverse motion of the water at low velocities, resulting in helicoidal flow. A part is then consumed by friction, and the remainder produces superelevation at the outside of the bend.

A transverse flow, outward at the top and inward at the bottom, is the only means provided by nature to establish equilibrium.

James W. Pearl.

Chicago, Ill.,
September 30, 1933.

Continuous-Beam Design

Sir—With reference to my article on "Continuous-Beam Design by the Fixed-Point Theory" (*ENR*, June 29, p. 842), I wish to express my thanks to R. McC. Beanfield and Robins Fleming for their comments, and to other engineers who have written direct to me about this article. Purposely, I did not submit any proof of the method on account of lack of space. However, the method can easily be checked mathematically. First, figure out the fixed-point distances from similar triangles. (For instance, BL'_2 and R'_2C in Fig. 4b.) The height of the parabola is $ql^2/8$. By means of other similar triangles the moments at the supports B and C may be found.

The method of characteristic points devised by Fidler is good, but it requires that a diagram be made up for every load condition. Also, it is very hard to remember all the details of the diagram construction.

The same objections apply to the methods presented by L. H. Nishkian and D. B. Steinman in their excellent paper "Moments in Restrained and Continuous Beams by the Method of Conjugate Points." (*Trans.*, Am.Soc. C.E., Vol. 90.)

In the Culmann-Ritter method the fixed points are determined only from the relation of the spans to each other, in complete disregard of the loading. Once determined, the fixed points remain the same whatever loading combination is used. The graphical construction of them is easy to remember, and is always the same regardless of the number of spans. With the fixed points located, each span can be treated separately, and the moments are expressed by the cross-lines, which are functions of the moment area in the loaded span, considered as a single beam freely supported.

Another advantage of the fixed-point theory is that it can be applied to beams with varying moment of inertia, to beams with elastic supports and to frames. One more line in addition to the third-point and the reversed third-point lines is introduced—the elastic line.

Sept. 28, 1933.
East Orange, N. J., Odd Albert.

Engineering News-Record

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Rising Contract Volume

REPORTS of contract awards show a continuous increase in work put under construction, and the rate of increase is accelerating noticeably, with every indication that it will continue through the remainder of the year. Consecutive four-week periods since the beginning of July show weekly contract totals of 12.6, 13.8, 21.2 and 39.0 millions—the last-mentioned figure applying to the four weeks ending with the Oct. 19 reports. That the construction curve is bending so sharply upward even in October is a condition unprecedented in construction history. Quite obviously it signifies abnormally active late-fall and winter construction. When taken in conjunction with the rate at which approvals have been going through the Public Works Administration during the last few weeks, many of which will go to contract within the next six weeks, it gives certain promise of sharp increase in employment and in the various business activities directly concerned in construction. There is equally good promise of a maintained stimulative effect on industry in general through the wage and business purchasing power which the contract awards imply. In view of this effect it is evident—since the principal part of the increase is in public contracts—that the PWA is now producing results. Full construction revival still awaits reactivation of private construction, which at its present level of one-fourth the total volume remains far below normal.

Expansion to Be Controlled

IN ADDITION TO the progress of the construction codes, two important NRA developments of the week are to be noted for their potential influence on construction. They are the government's assumption of control over industry expansion and the long-awaited definite affirmation by the President of the employer's right to choose his employees on merit. Construction has not been devoid of trouble from excess productive capacity as well as labor interference with employee selection, but it is most directly affected by capacity control. Many of its supplying industries, both of materials and of equipment, are sufficiently developed to meet even peak-year demands with high efficiency. Where this is the case, building a new plant can be justified only on the score of new and better process or else of service to a previously neglected territory; under any other circumstances it is an invitation to the established industry to buy out the interloper on a nuisance-value basis. Since every such purchase has to be paid for ultimately by the consumer, it is economy to prevent unreasonable expansion. So long as this is not allowed to repress enterprise or protect obsolescence of plant or management—the latter by no means the least consideration—it represents sound industry control in the interests of the public. Applying to industry at large the principle of expansion control long current in railroad and utility supervision, it involves far greater difficulties and hazards, and its success will depend altogether on fair and far-sighted administration.

Metal-Faced Dams

LESS than two years ago a steel-faced rock-fill dam was built for the Broadmoor Hotel at Colorado Springs, Colo. (*ENR*, May 26, 1932, p. 761). It was the first metal-faced dam to be built in this country since the opening of the century, when one was built for the Pikes Peak Power Co., also in Colorado. Now a third, much larger than either of the other two, is to be built in New Mexico. Details of the proposed structure, the El Vado Dam of the Middle Rio Grande Conservancy District, are given elsewhere in this issue. It differs from the earlier dams in that the body of the dam is to be a gravel fill with much flatter slopes and consequently a greater area of metal face per foot of height. Joints are to be welded, as for the Broadmoor dam, and elaborate provision is made for expansion. The design details given in the description of the El Vado Dam are those upon which bids are to be called, but the district will consider other designs. New alloys and fusion welding have opened up new possibilities in the application of steel to dam construction, as was pointed out by several engineers in the discussion of steel dams published in these pages last year. The opportunity given to bidders on the El Vado Dam to submit designs of their own making should help to develop the possible economies of the application of steel to dam construction. Few fields of engineering activity offer greater opportunities for original thinking.

The Sanitary District Loan

BY ALLOTTING eight million dollars to the Sanitary District of Chicago for sewage-plant construction, subject to a satisfactory financial contract, the Public Works Administration has made direct provision only for completing work already begun, but this action justifies the hope that eventually means for financing a larger part of the undertaking will also be worked out. The Sanitary District's program will present a large measure of unemployment relief in a district where such relief is badly needed. The completed improvement will be of great social benefit, easing treaty negotiations with Canada over the St. Lawrence waterway, ending downstate pollution of the Lakes-to-the-Gulf waterway and, above all, ending a hazard to the health of nearly four million people. But the financial difficulties loom large in all negotiations. The Sanitary District has had great misfortune in connection with its tax revenue, and it now has $15,000,000 of bonds in default. Perhaps some further security, such as a mortgage on the district's large real estate holdings or a lien on the millions owed the district by the city of Chicago for electricity, might make a more attractive bargain. Really cooperative action is necessary, a willingness on each side to compromise where necessary. The present delicate balance of the recovery program cannot allow the luxury of legal pettifogging or bureaucratic procrastination. The Sanitary District project is a meritorious piece of public-works activity, which should be utilized to the full in assisting economic recovery.

Federal Housing

IN THE THREE MONTHS since the PWA began functioning none of its activities has been more diligently pushed than those pertaining to loans for low-cost housing. Projects in about a dozen cities have been allotted nearly $45,000,000, and favorable action is said to be imminent on a number of other proposals. This is an excellent record, but so much delay is being encountered in transposing the allotments into jobs that the PWA is making plans to organize a federal housing corporation to build and lease or sell low-cost housing. The operations of this corporation, according to the proposal, would be carried on in any city of the country that its officials fixed upon; the city might or might not request or desire the housing.

Such a plan immediately raises many questions. As an emergency measure to get low-cost housing under way for its beneficial effect on unemployment and business, a federal housing corporation has certain possible advantages. As a means of establishing a yardstick by which the costs and benefits of low-cost housing could be measured, much as the TVA hopes to establish a yardstick for electric power rates, a federal housing program offers other advantages. But its possible future effects are far too serious to warrant a quick and favorable decision on these advantages alone.

What are some of the disadvantages? In the first place, the United States has no well-formulated low-cost housing policy, as have some countries in Europe. In so far as it has a policy at all, supervision has tended to be lodged in the state governments, following the lead of New York State in establishing a state housing board some years ago. The activities of these state boards have centered on control of private limited-dividend housing companies. No public housing has been tried, and only Ohio, with its recent law providing for district housing authorities, and a few cities in other states, by virtue of "home rule" ordinances, have a set-up that contemplates government ownership in any sense. A federal housing program, therefore, would have to be looked upon as entirely experimental, with only European precedent to draw upon. Whether such foreign experience has much value to American practice is questionable, for in Europe the central governments have engaged in all sorts of business for so long that a different public psychology exists. It would be difficult to convince the citizens of many cities in this country that their housing situation is serious enough to warrant federal construction.

The sudden entrance of the government into a sphere of influence heretofore completely dominated by local authority and opinion raises the principal question with respect to the wisdom of a federal housing program. There are other questions, however. For example, how many local government or limited-dividend corporation projects, now actively being planned, would be scuttled if a federal corporation entered the field? If these should be numerous, unemployment actually might be hindered instead of helped. Assuming, however, that the federal housing corporation is decided upon, how much administrative expense would be necessary? How long will it take to set up an organization that could function? Would this period be longer than would be required for other states to follow Ohio's example in setting up public housing authorities? Are we prepared to contemplate having the federal government permanently in the real estate business?

A housing program such as is proposed is by far the most extreme of the many recovery schemes yet advanced. It is not only a social experiment, such as the Tennessee Valley plan, but it also contemplates taking over a job that has heretofore been entirely local in character. This fact should be squarely faced, for until our governmental and social philosophy is radically changed, housing is inherently a local problem and can best be supervised locally. If it is coupled with slum clearance, the need for local supervision is even more urgent. Federal construction of low-cost housing may be necessary as an emergency measure, but a permanent policy for low-cost housing would better be based on some such agencies as the Ohio housing authority district law contemplates.

Construction Self-Government

WITH the completion and approaching approval of its major codes, construction is on the threshold of a new era, one of self-government. What has hitherto been a hopelessly disorganized group of activities is to become a coordinated industry embracing in one coherent system every operation of design and construction from dwelling house to Boulder Dam.

The transformation promises to be revolutionary. Unsound and unethical practices are to be banned, and the chiseler and the parasite are to disappear. Not only are the business conditions of construction to be improved, but its professional conditions are to be made better, and (with luck and persistence) a beginning is to be made in creating stable labor relations. Finally, for the first time factual study and industry planning will become possible.

Code drafting has been a tedious operation, slow enough to cause much grumbling and discouragement. Time was required to bring together in reasonable understanding of unity the numerous diverse elements that participate in construction, from engineer to subcontractor. Had it not been for the effective preparatory work done by the Construction League during the past two years and by the Highway and Building Congress last January, the time would doubtless have been even longer. Yet few industries are as greatly in need of effective organization as construction, for in both spirit and structure it is antiquated—as primitive as the manufacturing industry of forty or fifty years ago.

Self-government means more than codes, for these are only the fundamental documents by which the government is to be carried out. To apply the principles laid down in the codes calls for wise administration. It is a formidable task to set up a system under which many trades and many kinds of men can cooperate constructively and equitably in the complex operations of engineering and building construction. Most weighty of the responsibilities that will rest on the administrators is that of laying a foundation for permanent construction organization and control. Little good can come from self-government that endures only for the short life of the Recovery Act, and if integration of construction is to survive that period it must be on the basis of voluntary cooperation. Successful administration of the codes, however, will give proof to all divisions of the industry that self-government is to their advantage, and through this recognition it will be possible to continue the system and accomplish lasting reform.

NEWS OF THE WEEK

All-American Canal Gets $6,000,000 For Start of Work

START of construction on the All-American Canal to supply irrigation water to the Imperial Valley in Southern California has been made possible by an allotment of $6,000,000 to the work by the PWA board on Oct. 24. The Coachella project is not included nor is provision made for power development or for water supply for the city of San Diego. The initial allotment will permit construction by the Bureau of Reclamation of the first section between the Colorado River and Hanlon's Landing. Plans for the work have been prepared. The project will be self-liquidating, as provided by Reclamation Act under which government is reimbursed by water users. The canal will be located entirely on American territory.

Allotments reduced

Pursuant to policy applied to the All-American Canal and Fort Peck Dam of making allotments only as needed, the board has released for allotment to other projects funds originally alloted to Grand Coulee and Casper-Alcova that will not be needed during the first year. This represents retreat by Secretary Ickes from his initial stand that PWA would not start anything it might not finish. This week he dismissed with a shrug of the shoulders the possibility that diverting funds that eventually will be needed to complete these big projects may become a bar to their completion. Funds will be advanced as needed according to Secretary Ickes, but this method assumed that all work will be completed before the public works funds are all distributed.

Conference postponed

The conference of state officials for settling the controversy over division of the North Platte waters among Wyoming, Colorado and Nebraska, scheduled to be held in Washington Oct. 23 has been postponed until Nov. 6. Start of work on the Casper-Alcova project depends largely on settlement of this controversy.

Postal substations

Allotments announced Oct. 24 included $14,208,400 for construction 86 postal substations in Chicago, Boston, Brooklyn, New York, Cleveland, Philadelphia and Pittsburgh, to be supervised by treasury department; $250,000 for road and trails in Alaska. $2,500,000 to Federal Emergency Relief Administration for supervision and cost of materials and equipment required for work-relief projects. The PWA scale will not be paid to labor on such projects. Wages will be paid out of Relief Administration funds which cannot be used for supervision of work, materials or equipment. This allotment is subject to submission of specific projects to PWA. Several being examined include malaria and other disease control work and rodent extermination.

Engineers appointed

Robert A. Allen, engineer former member of Nevada Public Service Commission, has been appointed state engineer for Nevada; W. F. Cochrane, former city engineer of Watertown, appointed for South Dakota, and George M. Neel, Santa Fe consulting engineer, for New Mexico. Heretofore the state engineer for Utah served Nevada, North Dakota served South Dakota and Arizona served New Mexico. The separation was made to speed up the program in such states.

Appropriation of funds

With reference to statements by several Congressmen arriving in Washington recently that it is their intention to propose appropriation of more funds for public works at the next session, Secretary Ickes said it is still too early to consider that question.

Infusion of politics is becoming a serious obstacle to selection and handling of projects in Nebraska, California and Nevada and it is feared this disorder will spread to other states. The strife is sectional rather than partisan. Secretary Ickes has urged state boards to put political considerations aside but as long as PWA must deal with political bodies whose officials are elevated to office by ballot, it is becoming more evident that politics is inherent in whole scheme of public works. The PWA sought to prevent abuses by excluding dyed-in-the-wool politicians from appointment as members of state boards and regional advisers.

Protests from Nebraska that the state has not had its share of PWA funds were brushed aside by Secretary Ickes with remark that the state has been slow in putting its road allotment to work. The PWA record reveals that of 20 applications from Nebraska, allotments have been made on seven, and that two, Sutherland and Tri-County have been held up for joint consideration. Others will be acted upon soon.

Building modernization

Numerous loans have been made for modernization of public buildings and institutions but the PWA has not put much emphasis on this phase of program as it does not wish to invite an avalanche of applications for small loans. The administration does not have facilities for handling small loans and an attempt to do so would not only increase administrative expense but slow down public works proper. The PWA now has 1,900 projects on docket and wishes to avoid entanglement. When heating and ventilation, plumbing, elevators, sprinkler systems, refrigeration and air conditioning represent substantial capital improvements, they are eligible for consideration on merits of each case. The PWA tends to go further along this line in connection with new buildings than old.

Secreary Ickes announced on Oct. 24 that housing corporations articles of incorporation are ready for filing in Delaware.

Steel Fabricators' Meeting Centers on Codes and Housing

THE American Institute of Steel Construction held its eleventh annual meeting in Chicago, Oct. 17-21. The steel fabricators' code, which comes up for NRA hearing on Oct. 30, dominated the business sessions of the convention, while housing was the principal subject of a technical nature that was discussed. The annual banquet was addressed by Henry M. Waite, deputy administrator, PWA, and Myron Taylor, chairman of the board, U. S. Steel Corp.

Institute activities

In his annual report Charles F. Abbott, executive director, listed some of the technical activities of the Institute during the past year. These included fire tests on steel-plate-floor fireproofing, load tests on similar floors and a continuation of the wind studies on the Empire State Building. A new formula for use in driving H-piles is expected to be developed from tests now under way. Revisions of plate-girder information in the standard specifications are being made.

The report also stated that shipments made by 222 companies plus estimates of shipments made by 228 other companies for the first six months of 1933 totaled 375,000 tons against 1,000,000 for the whole year of 1932 and 1,178,000 for 1931. Between 1931 and 1933 some 200 companies have retired from the field, leaving 462 active steel-fabricating organizations. The Institute's income for the year 1932 was $110,000, the smallest since 1925.

Steel housing

F. T. Llewellyn (U. S. Steel Corp.) led a symposium on steel houses, which included descriptions of German and French practice by Otto von Halem, of Dusseldorf, and L. Icre, of Paris. The German buildings of special interest to the steel industry are standardized mass-production houses. In Germany these houses are almost exclusively used in settlements on the outskirts of cities, since steel cannot compete with local materials far out in the country. Some large private homes have also utilized steel. Some of the mass-production homes have a steel frame and thin walls consisting of an outside layer of sheet-steel or asbestos backed up by an insulating layer of cork, seaweed, peat boards, etc. Light sheet-steel sections reinforced with metal lath are used for walls and floors of another type of home. So far, the most popular design is that which uses the steel-lamella type of construction; more than 1,500 residences of this design have been built in Germany. The standard building element consists of a steel lamella ⅛ in. thick, 45½ in. wide and 9 ft. high, flanged on all sides.

In discussing welding practices in Ger-

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Low Water Again Forces Cut In St. Lawrence Waterway Draft

Continued low water in the Great Lakes has resulted in a new cut in the permissible draft of vessels proceeding through the St. Lawrence canals between Montreal and Prescott on Lake Ontario. The draft, normally 14 ft., now has been cut to 13 ft. 3 in. Below Montreal difficulties also are being encountered and construction of a compensating dam below Lake St. Peter (a widening of the river below Montreal) is being considered.

Because of the serious effect of the low water in the St. Lawrence waterway, it is reported from Ottawa that the federal government is considering the appointment of a commission of engineers to look into the whole matter of increasing the low flow available for use in the navigable channels of the river.

Elevated Motor Ways Proposed To Speed Up Chicago Traffic

Following six years of study the third and final report on an elevated highway plan for Chicago involving ultimately a 160-mile development and an immediate program of 15.26 miles has been presented by the city council committee on traffic and public safety, jointly to the state, county and city. For abstracts of the first and second reports see *ENR*, Apr. 27, 1932, p. 535 and Nov. 24, 1932, p. 612.

Four general conclusions resulted from the study: (1) The traffic problem of Chicago is an integral part of the state highway problem and should be so considered in any future program for state highway financing and construction; (2) "Limited way" construction for motor vehicles only, permitting no cross traffic or access to abutting property, is the only satisfactory method of solving the major traffic problems of the metropolitan area; (3) To insure the maximum possible immediate returns the first steps should be at the most congested points; (4) Any program for limited way construction should be financed from current motor vehicle taxes. This pay-as-you-go policy is possible with funds now allocated to Chicago and Cook County by recent legislation without adding to the tax burden.

A flat, open-grid pavement of steel or concrete is proposed, of four- or six-lane construction with center curb. Lights would be placed continuously along this curb and the inside surfaces of the guard rails in projectors so set that no source of light would be exposed to the eye of the driver. On account of the small number of trucks, 10 per cent of total traffic, the limited way would be restricted to passenger vehicles, thus segregating a group of like speed characteristics and permitting a low live-load of 75 lb. per sq.ft.

Costs of four-lane construction have been estimated at $431,000 per mile for passenger loading. Street widening projects in Chicago on Ashland Ave., Western Ave., and La Salle St. have cost $384,000 per average mile per additional 10-ft. lane gained by the improvements as compared with $107,750 by the limited way method. The latter also will provide 80 per cent more traffic capacity.

An elaborate study was made of land values on widened and unwidened streets, resulting in the conclusion that no unusual or special benefits will be obtained. Limited ways can be built in existing streets with nominal damages only at 15.5 per cent of the sum required for the purchase of equivalent capacity by surface route widenings. The cost comparisons give no weight to the economic savings to the motorist in terms of increased facility of movement and overall speeds in excess of 40 miles as compared with overall maximums of 20 miles on surface routes.

Four units are proposed to be built now, westerly in Randolph and Lake Sts. from the business district to Ashland Ave.; a second to the northwest in Kingsbury St. and over railroad rights of way from the Merchandise Mart to Ashland Ave.; a third to the southeast in Jackson Park and Stony Island and in South Chicago Ave. and a fourth to the southwest in Archer Ave. The four units are estimated to cost $8,000,000, a sum available from the gas tax distribution to the city and county.

The report was made under the direction of John A. Massen, chairman of the committee on traffic and public safety by Miller McClintock, director, the Albert Russel Erskine Bureau, Harvard University.

Wurts Bros. Photo

NEW EXCAVATION WORK BEGINS IN ROCKEFELLER CENTER

As the first step toward the construction of the Palazzo d'Italia and still another 9-story building of duplicate design that will complete the Fifth Ave. frontage of the Rockefeller Center development in New York City, excavation has begun on a plot 200x550 ft. between 50th and 51st Sts. The two nine-story buildings will occupy only the front 200 ft. of the plot, the remainder being reserved for a 38-story office structure and another 9-story building adjacent to the Radio City Music Hall, shown at the right in the above view. No definite announcement of the construction of the latter two buildings has yet been made. Excavation for the foundation of all four buildings, however, is being carried out at present for reasons of economy. The work involves the removal of about 175,000 cu.yd. of earth and rock, to a maximum depth of 60 ft. below the curb line. It will be handled by the George J. Atwell Foundation Corp.

Plans are also under way to complete the underground facilities of the three-block site. These facilities which were described in *Engineering News-Record*, Nov. 17, 1932, an issue devoted entirely to the Rockefeller Center development, include provision for some ¾ mile of pedestrian tunnels and passageways, 16 ft. wide and 14 ft. high, connecting all buildings at the first underground level, and at the next lower level four-lane vehicular roadways leading from the street into a delivery and shipping area 320 ft. long and 185 ft. wide located 34 ft. below the street in the central block. A petition was recently addressed to the city board of estimate requesting permission to extend these vehicular and pedestrian facilities under 49th and 50th Sts.

With the completion of the two Fifth Ave. buildings, 8 of the 12 structures originally planned will have been built. The 70-story RCA building has been occupied since April of this year. The 6-story British Empire building (at the left of the photo) was completed a short time later. The duplicate building, La Maison Francaise, to the left of the British building (but not shown) now is practically complete. Landscaping of the roofs of these two buildings and of the promenade between them that leads to a sunken plaza in front of the RCA building has also been completed recently.

Steel Fabricators' Meeting Centers on Codes and Housing

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many, Mr. von Halem stated that, for use in welded I-beams, one of the mills is rolling flange plates with a protrusion on one side into which the web plate can be inserted and welded; this is claimed to eliminate any possibility of flange warping.

The future development of steel in the house field, in Mr. Llewellyn's opinion, will be found in houses of individual, non-standardized design, as distinguished from the mass-production house. He advocated making available a suitable variety of rolled-steel sections, with simple rules and tables to facilitate their use. While the application of steel to housing under such a plan is not so sensational as mass production, it has the merit of making available for immediate use by a large number of people the results of an intensive study of the present problem based on accumulated experiences in other fields. Studies by the U. S. Steel Corp. of 10 different systems indicated: (1) That there is widespread interest in steel-frame, one- and two-family houses of individual design; (2) Steel can be used for any style of architecture to provide a satisfactory frame; (3) Certain new practices not in the current handbooks can be employed with safety and economy; (4) With suitable information, steel framework can be designed by architects as readily as other materials; (5) Details can be developed to advantage in cooperation with the local fabricating shop; (6) Fabrication and erection requirements are simple and well suited to the equipment of the smaller structural or sheet-metal shops.

Colonel Icre, in his address, said that in 1928, when the French steel industry began to promote housing, architects lacked technical knowledge of the use of steel in buildings. Steel in France is slightly more expensive than concrete, but by greater speed in erection it is believed possible to overcome this disadvantage. Some small houses have been erected in 48 hours. Opposition of architects and building contractors to anything new is a heavy handicap in France, so that much educational work is essential.

In a talk on the Sky Ride at the Century of Progress, D. B. Steinman described some of the technical features of this unusual transporter bridge and pointed out that this type of construction (unstiffened suspension system) should offer decided advantages for low-cost long-span bridges.

H. M. Waite, deputy administrator PWA, outlined the organization, work, problems and accomplishments of PWA. One of the difficulties, he noted, is the cumulative effect of increased prices due to codes on top of higher prices, resulting from speculation. He called on the steel industry to do its part in helping the railroads buy rails, by reducing costs. Applications are in for six-months tonnage, but bids are over the estimates. "Isn't it time," he queried, "for the industry to spread its overhead and not try to figure it all in a possible tonnage that would at least help to start the wheels moving?" Colonel Waite spent the day in Chicago previous to the meeting in working out possible means of decentralizing the legal phases of PWA applications and bond contracts.

Revised Subway Plans for Boston Considered by Commission

The emergency finance commission at Boston, Mass., has taken under consideration the revision of plans for a subway under Huntington Avenue to provide for a shorter tunnel and several surface traffic improvements. The commission recently rejected a proposal of Mayor Curley to build an $8,500,000 subway under Copley Square and Huntington Ave. to the Boston Opera House. The estimated cost of a subway from Clarendon St. (Copley Square) under Huntington Ave. to West Newton St. is $2,500,000, and it is proposed to combine with this outlay a further expenditure of $900,000 for an underpass at Symphony Hall, an overpass at Huntington Ave. and Jamaicaway, a traffic circle at Forest Hills and an underpass at Cottage Farm Bridge, Commonwealth Ave. All surface cars would be removed from Boylston St. and Copley Square by the proposed shorter subway.

Public Housing Authority Named in Cleveland

The personnel of the Cleveland Metropolitan Housing Authority District was named on Oct. 19. This is the first public housing body to be organized under the new Ohio state law which authorizes the State Housing Board to designate public housing districts that can build and operate low-cost housing and be eligible for a 3 per cent grant from the PWA. The Cleveland organization is made up of Robert M. Calfee, lawyer and president of the Associated Charities; John C. Cline, former brick manufacturer and contractor; Eugene Quigley, president of the Catholic Charities Corp.; Max S. Hays, editor of the *Cleveland Citizen*, and Marc C. Grossman of the Jewish Social Service Bureau.

Ernest J. Bohn, city councilman and leader of Cleveland's low-cost housing planning, has been spoken of as the probable choice for managing director of the Housing Authority.

Sewage-Treatment Topics Feature Program Of Central States Sewage Works Asso.

COMPREHENSIVE résumés of the developments in the use of chemicals and mechanical equipment in sewage treatment featured the program of the Central States Sewage Works Association, which met on Oct. 12-13 at Indianapolis, Ind. Trade-waste control, odor reduction, gaining public support for sewage-works construction and financing methods were also covered. The progress of the public works program in the Middle West was another topic that was given a great deal of attention.

Chemical treatment

Advances in chemical treatment on which emphasis has recently been directed in increasing measure were summarized by F. W. Mohlman, Sanitary District of Chicago. Because of its significance, this paper will be abstracted at greater length in our pages in a forthcoming issue. Dr. Mohlman's conclusions indicated that chemical coagulation undoubtedly has a field of usefulness intermediate between plain settling and complete biological treatment.

F. H. Waring, Ohio state sanitary engineer, in discussing Dr. Mohlman's paper, called attention to the extravagant claims too often made for chemical processes. Frequently these claims are made to public officials who thereby become confused as to the best methods of treatment to employ. This is what has happened at Columbus and at East Palestine, Ohio. At both these cities complete treatment is required by local conditions and construction plans already have been prepared. Promoters of chemical processes, however, have proposed chemical treatment to be followed by biological processes. Mr. Waring stated that it was his belief that each case should be considered on its merits and tests made at the expense of the proponents.

M. W. Tatlock, Dayton sewage works, reported that by using 75 lb. chlorine and 100 lb. lime per m.g. of sewage, odors have been brought under control during a record low flow in the stream receiving the effluent.

E. B. Besselievre, New York, presented an exhaustive 62-page treatise on the mechanization of sewage treatment. He stated that one type of mechanical equipment for sedimentation basins is now used in 497 plants and that he estimated as many more plants use other types.

Langdon Pearse, Chicago, Ill., called attention to sludge-bed cleaners. At Springfield, Ill., there is being developed a small tractor with low-hung 1-yd. bins into which dried sludge is thrown. He indicated that the successful development of such equipment might make possible the elimination of tracks and cars from sludge beds.

Trade-waste pollution

The tendency toward cooperation between industries producing objectionable wastes and sanitary authorities in remedying stream pollution conditions has been productive of good results, according to L. F. Warrick, Wisconsin state sanitary engineer. The American Pulp and Paper Association and the American Petroleum Institute have both spent large sums for research on this problem. As a consequence, in many cases the utilization of the wastes has yielded a return to the industry in excess of the cost.

Gus H. Radebaugh, Urbana and Champaign (Ill.) Sanitary District, presented a paper on "Selling Sewage Treatment," which analyzed the obstacles frequently encountered in gaining public support for the construction of sewerage facilities. Mr. Radebaugh suggested that in promoting such construction, the public health aspect should be emphasized. In discussion of this paper, H. C. Delzell, general field representative of the American Water Works Association, engaged in promoting PWA projects, outlined the tactics employed to gain a favorable vote on the referendum on a sewage loan at Bloomington, Ind.

Abel Wolman, PWA engineer of Maryland, speaking on "The PWA and Your

Town," outlined the national program and urged officials and engineers to speed action in perfecting applications. He gave as his opinion that as time goes on, there will be closer coordination between the geographical allocation of public-works funds and the need for employment.

H. F. Ferguson, Illinois state sanitary engineer, reported the Oct. 1 status of PWA projects in Illinois as follows: 36 projects, $17,000,000, have been sent to Washington, of which 6 have been approved; 83 projects, $47,000,000, have been heard by the advisory board; 32 projects, $24,000,000, are in form ready for hearing; 210 projects, $80,000,000, are not in form and are still in the promotion stage. Most of these projects are for sewerage or water supply improvements.

Sewerage-service charges in use in Bloomington, Ind., were outlined by Carl Carpenter, city engineer. The rate is based on water consumption as measured by water meter, and the amount is added to the water bill. The first 2,000 gal. per month cost 12½ c. per 1,000 gal.; the next 3,000 gal. 10 c.; the next 5,000 gal., 9 c.; next 10,000, 8 c., next 30,000, 7 c.; next 50,000, 6 c.; next 100,000, 5 c.; next 150,000, 4 c.; next 250,000, 3 c.; all over 600,000, 2 c. per 1,000 gal. The minimum charge is 25 c. per month, and 22 per cent of the users will have this rate. W. W. Moorehouse, director of the department of water and sewage at Dayton, reported that delinquencies in sewerage service charges in that city are small.

Michigan Improvement Program Held Up by Legal Difficulties

A proposed construction program totaling $25,000,000 for the state of Michigan, to be financed with PWA funds, is held up because of the provision in the state constitution prohibiting officials from pledging the state credit without the vote of the people. In order to permit the program to go ahead, the Governor recently recommended to the Public Works Board that it lease state land and undertake the building program without state participation, but the board has declined to take such action.

Suit Brought on Proposed Use of High-Silica Cement

An action was filed on Oct. 11 in the San Francisco superior court by the Pacific Portland Cement Co., seeking to restrain the Golden Gate Bridge and Highway District from substituting high-silica cement for portland cement in the south pier of the Golden Gate Bridge. The Pacific Portland Cement Co. has been furnishing portland cement for the job. The court is asked to void the alleged change in specifications for cement, on the ground that the high-silica cement contract was made in violation of a provision of the city's political code, which holds that public officers must not be interested in "any contract made by them in their official capacity or by any body or board of which they are members." One of the directors of the Golden Gate Bridge District is president of the Santa Cruz Portland Cement Co., which has been engaged to supply the high-silica cement.

Major General E. M. Markham New Chief of Engineers

Major General Edward M. Markham, whose nomination to be Chief of Engineers, U. S. Army, to succeed Major General Lytle Brown, was announced briefly in these pages last week, was sworn into office at Detroit on Oct. 17 and after addressing the Great Lakes Harbor Association, left for Washington to assume his new duties. Since 1929 General Markham has been division engineer, Great Lakes Division, in Cleveland. For four years previous to that time he was district engineer at Detroit. He also has served

Maj. Gen. Edward M. Markham

as a member of the Joint Board of Engineers on the St. Lawrence River Waterway and as a member of the Board of Engineers for Rivers and Harbors.

General Markham is a native of Troy, N. Y., and is a graduate of the U. S. Military Academy in the class of 1899. From 1907 to 1912 he was assistant engineer commissioner, Washington, D. C., in charge of the department of streets, water, bridges and sewers, and from 1912 to 1916 he was on Mississippi River work. During the World War he went to France in command of the 303d Engineers, later becoming assistant director of the Division of Light Railways and Roads and chief engineer of the Army of Occupation.

Rail Price Set at $37.75 To Stimulate New Purchases

A reduction in the price of steel rails from $40 to $37.75 a long ton is called for in new prices filed with the American Iron and Steel Institute by the Carnegie Steel Co., the Illinois Steel Co., the Tennessee Coal, Iron & Railroad Co., the Bethlehem Steel Corp., the Inland Steel Co. and the Colorado Fuel & Iron Co. These reductions were made at the request of Joseph B. Eastman, federal coordinator of transportation, who urged upon the steel companies a reduction in the cost of rail in order to facilitate the purchase by the railroads of about 1,000,000 tons of rails and fastenings. Mr. Eastman gave the rail companies to understand that the PWA was ready to finance purchase of the rails provided a satisfactory price could be obtained.

Allotment of Funds by PWA Exceeds Two Billion Dollars

ALLOTMENTS made by the Public Works Administration up to the end of last week exceeded $2,000,000,000 according to an announcement made Monday by Secretary Ickes. Of this amount, according to Secretary Ickes' statement, $1,802,000 has been allocated to federal projects and $247,650,000 to non-federal projects. In making the announcement, Secretary Ickes gave out a detailed statement of the allocations.

Information contained in the statement indicates that allocations to the Civilian Conservation Corps now amount to $321,000,000. Since Secretary Icke's announcement of Oct. 2, allotments to this work have been increased by $250,000,000.

Park roads and buildings

An allotment of $4,392,500 has been made to the Office of National Parks, Buildings and Reservations for the construction and repair of roads and buildings in national military parks and battlefields.

Fort Peck dam

An allotment of $9,500,000 has been made for the Fort Peck dam and reservoir project in Montana. This brings the total allocated to that work up to $25,000,000. The present allotment is to cover the cost of river diversion tunnels during construction. The reservoir to be built under this allotment is the larger of two considered by the Army Engineers in their report on complete development of the river. It is estimated to cost $84,000,000.

The Bureau of Indian Affairs has received $2,113,000 for the construction of Indian day schools; the Bureau of Lighthouses has received $153,532 for the repair of light stations and light ships damaged in the recent storms along the Atlantic Coast; $1,260,000 has been assigned to Howard University for the construction of a library and a classroom building, and $683,190 has been allocated to the Public Health Service for the construction of mess halls, quarantine stations, and plague laboratories at various points throughout the country.

Coast and Geodetic Survey

The Public Works Board has allocated an additional amount of $3,300,000 to the Coast and Geodetic Survey for field surveys and triangulation work throughout the country, and also for the procurement of equipment. It is estimated that this money will create 1,300 man-years of employment. The Survey received $2,600,000 in an earlier allotment. $25,000 has been allocated to the Geological Survey to start topographic map work in Porto Rico and $5,000 to aid in completion of a geologic map of California.

For flood control work near Nogales, Ariz., the International Boundary Commission has allocated $433,000 to complete the American section of the project.

Army and Navy work

Allotments of $10,000,000 have been made to the Army for motorization of its equipment and $15,000,000 has been allotted to

both the Army and Navy for aviation construction.

Non-federal allotments

Allotments to 111 non-federal projects totalling $15,363,000 were announced during the week. Details of the first group, totaling $10,119,514 are given in the accompanying table. The remainder will be published in next week's issue.

Roadside improvement

In an effort to inaugurate a national roadside improvement campaign, the Public Works Administration has stipulated, by resolution, that insofar as practicable and feasible the rights-of-way for highways built with loans or grants from public works funds after Jan. 1 shall be at least 150 ft. wide to accommodate footpaths and screening by planting shrubs and trees. Safety of pedestrians and restricting signboards and other wayside eyesores are cited by PWA as the beneficial results of such a program.

In order not to delay the progress of highway costruction with the public works unemployment relief funds, discretion is given to Thomas H. MacDonald, chief of the Bureau of Public Roads to determine the scope of the roadside improvement campaign.

Officials of the PWA explained that, in general, the right-of-way provision will be considered for application to projects on which plans have not been submitted by Jan. 1, but not necessarily applied to all of them. It is doubtful whether the PWA could legally force the requirement on the states but the board would like to make it stick both to roads built out of the direct $400,000,000 grant to the states by Congress and those whose cost is met by the allotment of other public works funds on a 30 per cent grant, 70 per cent loan basis.

Projected dams disapproved

Several projected low-cost dams in the southwest drouth area will not be approved by the PWA. The Army Engineers have reported that they are not economically justified but that one at Fort Supply, Okla., might have some merit as a work relief project. Secretary Ickes stated on Monday that the engineers' report will be accepted as final and that none will be built.

No loan will be made for the proposed drydock (Todd) at Houston, Texas.

DETAILS OF PWA LOANS AND GRANTS FOR NON-FEDERAL WORK

LOCALITY	LOAN & GRANT OR GRANT	TYPE	MAN-MONTHS WORK PROVIDED	AMOUNT
Cincinnati, Ohio	L. & G.	Water	1,920	$792,000
Clarke Co., Ga.	L. & G.	Rd. Imp. & Sch. Bldg.	600	103,630
Beloit, Wis.	L. & G.	School building	1,800	550,000
Shelby, Ohio	L. & G.	Sewage treatment	220	50,000
Springfield, Mo.	L. & G.	Sewers	6,480	1,000,000
Kansas City, Mo.	G.	Mun. auditorium	10,710	1,135,000
Bethany, Mo.	L. & G.	Sewers	600	135,000
Westborough, Mass.	L. & G.	Hospital	120	59,000
Merrimack Co., N. H.	L. & G.	Alms House	405	150,000
Boston, Mass.	L. & G.	State Hospital	600	177,000
Warwick, R. I.	L. & G.	Waterworks	250	60,000
Durham, N. C.	L. & G.	Sewer	3,300	710,000
Norfolk, Mass.	L. &G.	Dorm. State Prison	2,600	763,000
Tewksbury, Mass.	L. & G.	Infirmary	100	48,000
Northampton, Mass.	L. & G.	Power house	600	360,000
North Grafton, Mass.	L. & G.	State Hospital	210	132,000
Westborough, Mass.	L. & G.	Dining hall & kitchen	624	258,000
Tewksbury, Mass	L. & G.	Fire protec. at St. Inf.	360	138,000
Manchester, Ky.	G.	High School	77	5,600
Alexandria, Va.	L. & G.	Repairs, streets	2,000	300,000
Geneva, Ill.	G.	Sewer	80	4,000
Santa Clara Co., Calif.	G.	Water	90	6,600
Prettyboy, Md.	G.	Highway	116	3,400
Springfield, Minn.	G.	Water purification	40	2,500
Janesville, Minn.	G.	Paving	57	4,284
Trego Co., Kan.	G.	Bridges	264	9,000
Washington, Kan.	G.	City Hall	120	3,700
Lakin, Kans.	G.	Waterworks	3	1,000
Clay Co., Kan.	G.	Road construction	18	1,300
Pullman, Wash.	G.	Buildings	1,620	198,000
Spokane Co., Wash.	G.	Street improvement	400	22,300
Lawrence, Kan.	G.	Water	12	2,100
Spokane Co., Wash.	G.	Road grading	176	4,000
Dustin, Okla.	G.	Dam	210	5,000
Ft. Atkinson, Wis.	G.	Water supply	125	9,300
Oakley, Kan.	G.	Waterworks	28	2,500
Bloomfield, Iowa	G.	Waterworks	60	3,200
Falls City, Nebr.	G.	Water mains	138	5,400
Wake Forest, N. C.	G.	School building	300	15,000
Everett, Wash.	G.	Waterworks	572	38,000
Milwood, Wash.	G.	School	120	7,800
Cincinnati, Ohio	G.	Street improvement	2,790	71,000
Middlebury, Vt.	G.	Sewer	72	2,000
Cincinnati, Ohio	G.	Sewer	639	6,500
Cincinnati, Ohio	G.	Sewer	40	1,200
St. Louis, Mo.	G.	Hospital	2,000	274,000
Linton, N. D.	G.	Court House	350	24,000
Fresno, Calif.	G.	Highway	300	13,500
Cincinnati, Ohio	G.	Sewer	75	2,400
Lincoln Co., Wash.	G.	Street improvements	100	4,000
Iowa City, Iowa	G.	Buildings	1,500	92,000
Snohomish Co., Wash.	G.	Highway improvement	100	3,600
Sumas, Wash.	G.	School house	45	4,100
Jefferson Co., Wash.	G.	Road improvement	105	4,000
Dyersville, Iowa	G.	Sewer	50	700
Marshall, Mo.	G.	Jail & Sheriff's Res.	120	12,000
Ottumwa, Iowa	G.	Viaduct	3,600	50,000
Sedro Woolley, Wah.	G.	Bldg. for State Hosp.	360	28,200
Randolph, Wis.	G.	Building	36	1,300
Butler, Mo.	L. & G.	Sewage disposal	270	41,000
Belington, W. Va.	L. & G.	Filtration plant	210	45,000
Salt Lake City, Utah	L. & G.	School building	1,750	300,000
Pulaski, Va.	L. & G.	Bridges	210	30,000
State of Utah	L. & G.	State institutions	3,032	1,515,000
Nashua, N. H.	L. & G.	Removal of car tracks	1,650	173,000
Grand Co., Utah	L. & G.	School building	497	130,000
Suffolk, N. Y.	G.	Concrete paving	270	16,400
		TOTAL	58,317	$10,119,514

Delaware River Bridge Line Estimated to Cost $10,000,000

The Delaware River Joint Commissi will seek a PWA loan of $10,000,000 a a grant of $2,500,000 for its project high-speed transit line over the Delawa River bridge between Philadelphia a Camden instead of $7,500,000 as original proposed, according to action taken by t commission on Oct. 20. With a grant about 30 per cent, the original applic tion would have provided a sum of $1 000,000, but as the federal authorities a understood to have indicated that the pr posed line may cost more than this amou the loan application is increased in ord to give a total of $12,500,000 with a co bined loan and grant.

Duplication of Waterworks Opposed by A.W.W.A.

A resolution has been adopted by th national recovery committee for wate works construction of the American Wate Works Association, opposing the use o PWA funds for the purpose of establish ing new waterworks facilities in competi tion with existing privately-owned water works systems, except in those cases where it can be shown that the existing facilities are inadequate, poorly managed, or that the rates being charged are unreasonable. Furthermore, the resolution states that in the last mentioned cases, reasonable effort should be made through existing channels to rectify such unsatisfactory conditions before the construction of additional facilities is contemplated. The resolution states that such threat of competition, even though it does not later become a fact, is harmful and costly to the private enterprise involved.

Nebraska PWA Projects Make Slow Progress

Execution of loans for PWA projects in Nebraska has been held up due to sickness and death of A. C. Arend, PWA engineer for the state and due to the transfer of the regional administrator, Frank Murphy, from Omaha to Minneapolis. Projects submitted up to and including the first week in October are awaiting executive authorization or rejection. Criticized delay appears due largely to this indicated lack of an executive head of PWA activities. No particular opposition has confronted PWA projects except those for power and irrigation. Delay prior to Oct. 8 has been largely due to return of applications for more complete plans and financial statements. The power and irrigation projects, it is alleged, are being opposed by the existing power interests which are currently charged with undue political activity. These projects, some half dozen, submitted prior to Oct. 8 amounted to about $41,000,000, of which sum about $36,000,000 was for one project in two parts on which separate loans were requested. All these projects were presented by power and irrigation districts organized under the state law which permits the setting up of such districts as independent administrative bodies for their special purpose.

Large Sewage Disposal Scheme for Detroit Region Projected

Governor Comstock of Michigan recently called a conference of mayors of the cities and towns along the St. Clair and Detroit rivers to be held in Detroit on Oct. 25 to discuss construction of a sewage disposal system, estimated to cost $25,000,000, to serve communities along the two rivers.

As in the case of the projected sewage disposal scheme for the Buffalo region, it is hoped to obtain a grant covering the entire cost of the project from the federal government on the ground that the work will be carried out in fulfillment of the treaty entered into between Canada and the United States some years ago, calling for cleaning up the international waters.

Construction Codes Considered by New York Engineers

Codes for the construction industry were the subject of the first meeting of the current season of the Metropolitan Section of the American Society of Civil Engineers which was held in New York on Oct. 18. Stephen F. Voorhees, member of the society and chairman of the code committee of the Construction League of the United States, outlined the early history of the construction code movement and its importance in unifying the whole construction industry. He also described the organization set up to administer the code and pointed out that it was designed to keep control of the industry from falling into the hands of a bureaucracy. John P. Hogan, vice-chairman of the code committee, speaking from the viewpoint of the engineer's relation to the general code for the construction industry, stated that the lack of any all-inclusive organization in the industry up until two years ago had kept the industry from acting as a unit and pointed out that the code development offered to the professional groups, the architects and engineers, an opportunity to take the lead in putting the whole industry upon a sound basis.

Developments in connection with the engineers' code were outlined to the meeting by Carlton S. Proctor, chairman of the code committee of the American Society of Civil Engineers.

At the close of the meeting, Henry G. Babcock offered for consideration a resolution calling on the society to drop all the present code work and to divide itself into two groups, employers and employees, in order that proper consideration be given to the interests of the employee members of the organization. Because of the lateness of the hour, the resolution was not considered.

At the meeting of the board of directors of the section, held in advance of the general meeting, the board authorized the president to name a committee to take up the matter of the establishment of wage rates for employed engineers and engineering assistants under the engineers' code. This committee, cooperating with other engineering organizations in the New York metropolitan district, is expected to lay the groundwork for the establishment of wage rates in the New York metropolitan region under the section of the code that requires that such rates be set within four months after the approval of the code by the President.

SOCIETY CALENDAR

AMERICAN SOCIETY OF CIVIL ENGINEERS, annual meeting, New York, Jan. 17-20, 1934.

HIGHWAY RESEARCH BOARD, National Research Council, Washington, D. C., Dec. 7-8.

AMERICAN TOLL BRIDGE ASSOCIATION will hold its annual convention at Cincinnati, Ohio, Jan. 26-27.

NORTH CAROLINA SECTION, American Water Works Association, and the North Carolina Sewage Works Association, will hold a joint meeting at the Vance Hotel, Statesville, N. C., on Nov. 13-15.

Brief News

THE HALIFAX HARBOR COMMISSION will proceed immediately with the rebuilding of Pier 2, recently damaged by fire.

COMPLETION OF SAN GABRIEL DAM NO. 2 at Los Angeles, Calif., has been predicted for December by E. C. Eaton, chief county flood control engineer. The dam was begun in April, 1932.

IMPROVEMENT BONDS amounting to $2,275,000 are to be voted at a special election to be held in Spokane, Wash., on Nov. 21. Included in the work to be financed is a trunk sewer, a sport arena, minor sewers, paving and right-of-way for the Sunset and Inland Empire Highway.

A SUM OF $20,000 was left to the American Society of Civil Engineers under the will of the late J. Waldo Smith, consulting engineer to the Board of Water Supply of the City of New York, who died on Oct. 15, and $5,000 was left to the Western Society of Engineers, Chicago.

WORK HAS BEEN BEGUN on the Ladner Bridge across the Fraser River in British Columbia. Contract for the preliminary work is being carried out by the Terminal Engineering Co. of Vancouver, B. C. Recently the principal contract for the bridge, estimated to cost $2,100,000, was let to Dorman Long & Co., London.

A CONTRACT FOR 20,000 TONS of 30- and 42-in. diameter electric-welded steel pipe has been let by the city of Cleveland to the Alco Products, Inc., a division of the American Locomotive Co. The pipe is to be used in connection with the extension of the water distribution system in Cleveland for which the Public Works Administration recently made an allotment of money.

BELLINGHAM, WASH., at an election to be held Dec. 2 will vote on an issue of $150,000 utility bonds to finance a municipal power and light plant. The project calls for a dam and power plant in the vicinity of Cemetery Hill on Whattom Creek and the repair and use of the present plant at the mouth of the creek, which was abandoned in 1927. Application will be made for a PWA loan.

CHARLES R. WATERS, district highway engineer, Buffalo, N. Y., has just announced that Western New York's $2,275,000 road building program will be in full swing by December 31. The program is financed by funds from the Federal government under the National Recovery Act. More than 30 highways in Erie, Niagara, Chautauqua, Genesee and Wyoming counties are included in the program. Work already has started on several projects. Plans for the other units are virtually completed so that bids can be asked in a short time. All contracts are expected to be awarded by December 31.

STEPS HAVE BEEN TAKEN to create a Lower Rio Grande Valley drainage district to serve 60,000 acres of irrigated lands and reclaim about 75,000 acres. The proposed main drainage canal will cost about $5,000,000. A bill has been introduced in the legislature legalizing the formation of the district.

VALIDITY OF THE BONDS totalling $3,000,000 voted by the city of Tacoma, Wash., on Sept. 26 for sewer construction is to be tested in a friendly suit brought by a taxpayer. It is claimed that while the bond issue received a majority of the votes cast, the total number of votes fell below the legal requirements for a bond issue. The project includes two pumping plants, a screening plant, and a long outfall sewer into Puget Sound.

A STUDY OF PUMP EFFICIENCY, to be made in the research laboratory of the California Institute of Technology at Pasadena as a preliminary to the purchase of pumping equipment for the Colorado River aqueduct, has been recommended to the directors of the Metropolitan Water District of Southern California by F. E. Weymouth, chief engineer. This work, including equipment, is estimated to cost $88,200. Over $2,400,000 of pumping equipment will be required by the district in the next eight years and ultimately $4,400,000 worth of such equipment.

Personal

OLAF LAURGAARD, city engineer, Portland, Ore., has resigned following the institution of removal proceedings by the city council.

L. G. APPERSON, head of the bureau of construction, Portland, Ore., has been appointed city engineer to succeed Mr. Laurgaard.

M. C. EMANUEL, of Clayton, Mo., has been appointed an engineer examiner for the Missouri State Advisory Board of the federal Public Works Administration.

ROBERT F. HERDMAN, formerly with the Byllesby Engineering & Management Corp., Chicago, has joined the staff of the U. S. Bureau of Reclamation in its Denver office.

LESLIE G. HOLLERAN, formerly deputy chief engineer, Westchester County Park Commission, is now on the staff of the state engineer PWA for New York State in New York City.

FRED A. REEDENBACH, formerly assistant resident engineer, Holmes County, Ohio, has been appointed assistant to the federal engineer in the office of the director of highways at Columbus, Ohio.

L. R. BOWEN, former chief engineer of bridges and buildings for the city of St. Louis, Mo., has opened an office in St. Louis for the practice of civil engineering and architecture.

WALTER MATHIS, of Pueblo, Colo., has been appointed to the Colorado Highway Advisory Board by Governor Johnson to fill the vacancy caused by the resignation of Edward G. Middlekamp.

FREDERICK L. MORGANTHALER, JR., of Harrisburg, Pa., has been appointed junior

engineer for the reclamation bureau of the Department of the Interior and has joined the Denver office.

E. P. Coady, civil engineer of Columbus, Ohio, has been named temporarily as executive secretary of the Ohio Advisory Board for Public Works. He succeeds Fred I. Rowe, Hicksville, Ohio, who resigned to take up his contracting business.

Clark E. Mickey, head of the civil engineering department of the University of Nebraska, has been given a leave of absence in order to become engineer and manager for the Central Nebraska Public Power and Irrigation District at Hastings, Neb.

Eben G. Hitchings, principal draftsman in the office of the Inspecting Quartermaster, Fort Lewis, Washington, has been appointed chief draftsman in the U. S. Engineer Office at Portland, Ore., and assigned to the Bonneville Dam project on the Columbia River.

Glen H. Edgerton, Lieutenant Colonel, Corps of Engineers, for the past several years district engineer in charge of the Rock Island, Ill., district, has been promoted to the position of administering the War Department's system of waterway improvements and maintenance work.

Charles H. Graham, chief of the engineering division of the New York City Finance Department, retired from office on Sept. 30 after 52 years in the service of the city. Mr. Graham went into city service in 1880 as assistant in the park department. He entered the finance department in 1914.

Obituary

Emil De Ryss, an engineer of the Interborough Rapid Transit Co., New York, was accidentally killed while duck shooting on the Hudson River at Ossining, N. Y., on Oct. 18.

Charles F. Feine, August Feine & Sons, Inc., Buffalo, N. Y., died suddenly in that city on Oct. 19, age 45 years. Mr. Feine was a graduate of R.P.I., class of 1912.

Charles F. Conn, of the J. G. White Engineering Corp., died of heart failure at the Engineers Club, New York, on Oct. 20. Mr. Conn was a graduate of the Georgia School of Technology and had been with the J. G. White Engineering Corp. since 1907.

William J. Alcott, a member of the faculty of the engineering school of Northeastern University, died at Boston on Oct. 20, age 39 years. Mr. Alcott was a graduate of the engineering school of Tufts College and subsequently was on the staff of the bridge department of the Boston & Maine Railroad. During the World War he served with the 14th Engineers in France.

Robert Y. Stuart, chief of the U. S. Forest Service, was killed by a fall from a window of the Agricultural Department building in Washington on Oct. 23. Major Stuart was a graduate of Dickson College in the class of 1903 and from the Yale Forestry School in 1906. During the World War he served in the Forestry Engineers Corps in France. He had been chief forester since 1928.

Morris R. Sherrerd, chief engineer of the State water policy commission of New Jersey and consulting engineer to the department of public affairs, Newark, N. J., died suddenly at the Newark Athletic Club on Oct. 20. Mr. Sherrerd has been connected with water supply work in the metropolitan district of northern New Jersey since 1895 when he came to Newark as engineer of the water department. Ten years later he was appointed chief engineer of the department of streets and public improvements. Following reorganization of that department he became chief engineer of the New Jersey Water Supply Commission and subsequently of the North Jersey District Water Supply Commission, in which position he took an active part in the development of the Wanaque and Pequannock watersheds. Mr. Sherrerd was born in Scranton, Pa., in 1865 and graduated from Rensselaer Polytechnic Institute in 1906. Subsequently he was with the public improvement commission of Troy and after a brief period in private practice was appointed city engineer of Troy.

CONSTRUCTION STATISTICS OF THE WEEK

LEVEE and other river work, amounting to $12,000,000 maintained the federal contract total for the past week at the 15 million dollar mark, while highway lettings, the heavy item in contract awards the last few weeks, slumped to less than a third of the previous week's total, pulling the total of all contracts down to 60 per cent of the high total of the previous week. State and municipal contracts, other than highways, were small. Private construction followed road work in the downward trend this week, aggregating less than half of the previous week's total. Many large projects, both public and private, appearing in the lists of proposed work indicate that contract award figures should continue at a high level for some time to come provided these works are advanced to the contract stage. Large jobs awarded last week include: four hurricane gates for canal openings into Lake Okeechobee, $1,100,000; dredging and levees, Lake Okeechobee, $1,900,000 levees, lower Mississippi basin, $3,200,000; dredging Toledo harbor, $2,900,000, and a distillery warehouse, Peoria, Ill., $1,000,000.

CONTRACTS

(Thousands of Dollars)

	Weekly Average Week Oct., 1932	Prev. 4 Weeks	Oct. 26, 1933
Federal Government	$6,263	$13,707	$15,116
State and municipal	13,700	16,214	8,521
Total public	$19,963	$29,921	$23,637
Total private	5,249	8,906	3,884
Week's total	$25,203	$38,827	$27,521
Cumulative to date:			
1932	$1,015,506	1933	$818,360

NEW PRODUCTIVE CAPITAL

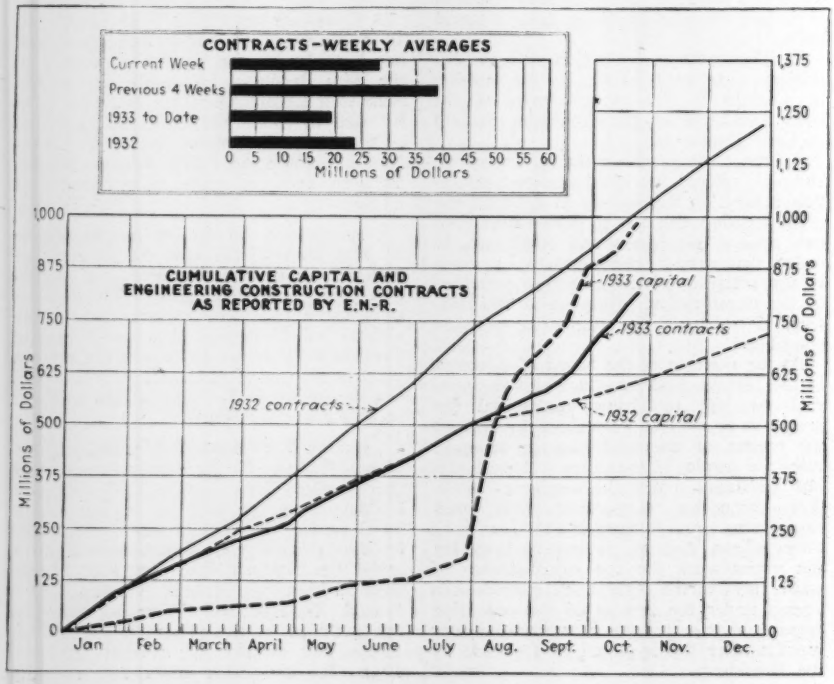
(Thousands of Dollars)

	Week Oct. 26, 1933	Cumulative, 1933
State and municipal	$4,970	$238,921
PWA allotments, public	12,074	653,693
Corporate issues	2,200	48,547
PWA allotments, private	....	46,573
Total new capital	$19,244	$987,734
Cumulative, 1932		$613,000

Note: These figures include private bonds and stock sold for productive purposes; state and municipal bonds for construction; R.F.C. advances for self-liquidating loans; PWA loans and grants to states and municipalities, including the special highway funds; and PWA private loans.

INDEX NUMBERS

E.N.R.-Cost		E.N.R.-Volume	
October, 1933	**187.74**	**September, 1933**	**122**
September, 1933	175.48	August, 1933	73
October, 1932	159.16	September, 1932	124
1932 (Average)	156.97	1932 (Average)	127
1931 (Average)	181.35	1931 (Average)	220
1930 (Average)	202.35	1930 (Average)	260
1913 (Average)			100


CONTRACTS—WEEKLY AVERAGES
Current Week
Previous 4 Weeks
1933 to Date
1932
0 5 10 15 20 25 30 35 40 45 50 55 60
Millions of Dollars
CUMULATIVE CAPITAL AND ENGINEERING CONSTRUCTION CONTRACTS AS REPORTED BY E.N.-R.
1933 capital
1933 contracts
1932 contracts
1932 capital
Millions of Dollars
0 125 250 375 500 625 750 875 1,000 1,125 1,250 1,375
Jan Feb March April May June July Aug. Sept. Oct. Nov. Dec.